

HIGHWAY RESEARCH REPORT

STATEWIDE FLEXIBLE PAVEMENT

PERFORMANCE AND DEFLECTION STUDY

INTERIM REPORT

68-36

STATE OF CALIFORNIA

TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

NO. M & R 633128

Prepared in Cooperation with the U.S. Department of Transportation, Bureau of Public Roads December, 1968



December 1968
Interim Report
M & R No. 633128
D-5-5

Mr. J. A. Legarra
State Highway Engineer

Dear Sir:

Submitted herewith is a research interim report
titled:

**STATEWIDE FLEXIBLE PAVEMENT
PERFORMANCE AND DEFLECTION STUDY**

ERNEST ZUBE
Principal Investigator

RAYMOND A. FORSYTH
AND DON O. TUELLER
Co-Investigators

Assisted by
Joseph B. Hannon

Very truly yours,

A handwritten signature in black ink, appearing to read "Beaton".

JOHN L. BEATON
Materials and Research Engineer

6-22

REFERENCE: Zube, E., Tueller, D. O., Forsyth, R. A. and Hannon, J. B., "Statewide Flexible Pavement Performance and Deflection Study", State of California, Department of Public Works, Division of Highways, Materials and Research Department, Research Interim Report 633128, December, 1968.

ABSTRACT: An interim report on a statewide flexible pavement performance and deflection study is presented. Data representing the present status of various projects comprising a total of 25 different structural sections with varying levels of traffic and pavement deflection are briefly discussed. Charts and tables are also presented. Studies to evaluate pavement performance, deflection attenuation properties of various roadway materials and radius of curvature of various highway pavements by the Dehlen "curvature meter" are also discussed. Contrary to the findings presented in the last interim report, pavement deflections continue to decrease after the pavement has reached an age of four years probably due to traffic compaction and AC curing. It is reported that preliminary computer analyses indicate that accumulative 5000 pound equivalent wheel loadings are the most significant variable in predicting pavement distress.

KEY WORDS: Flexible pavements, pavement deflection, pavement evaluation, pavement performance.

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ACKNOWLEDGEMENT

This paper is based on data collected during a research project financed by the U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads. The opinions and findings expressed in this publication are those of the authors and not necessarily those of the Bureau of Public Roads.

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July 1968

INTRODUCTION

Since the last interim report,¹ the scope of this project has been expanded to include "Statewide Flexible Pavement Study" (432398). This study was proposed for inclusion because it would prove beneficial by eliminating administrative and report duplication. Although the objectives differ somewhat, the investigational procedures are much the same and involve the same laboratory personnel. This phase of the study will provide information on the quality of structural section materials as well as evaluate design and construction procedures and relate these factors to pavement performance.

Approval for enlargement of this project was obtained on December 20, 1966.

The purpose of this report is to present the results of testing and data collection since the last interim report dated August 1966.

FINDINGS

1. Contrary to the findings presented in the last interim report, deflection levels continue to decrease after the pavement has reached an age of four years. This is presumably due to additional curing of the AC surfacing and additional traffic compaction. However, the rate of decrease in deflection level is considerably less than that of the first four years. Increases in deflection level are suggested in areas of block cracking where additional moisture has entered the structural section.

2. Preliminary computer analyses during this interim period of data from one test section from each of five of the Traffic Index-Deflection projects suggests that accumulative 5000 pound equivalent wheel loadings are the most significant variable in predicting distress, second is the hardness of the recovered asphalt binder in terms of penetration and third the pavement deflection.

TRAFFIC INDEX-DEFLECTION PHASE

At the present time this study involves 20 different projects throughout the state plus a series of streets in the City of

Woodland, California. Since the last interim report the following projects or test sections have been eliminated from this phase of the study:

| <u>Project</u> | <u>Remarks</u> |
|--------------------------------------|---|
| 3) 03-Gle-162 (64-14T13C6) | Overlayed with 0.08 foot asphalt concrete blanket in 1967 and dropped from study. |
| 4A) 03-Sac-99 (60-3TC20) | Three of the original five test sections were overlayed with 0.08 foot asphalt concrete blanket in 1968. The remaining two test sections are still part of study. |
| 9) 05-Mon-101 (62-5T13C4) | Seal coat placed in spring of 1968 and project was dropped from study. |
| 12) 05-SBt-156 (61-5TC3) | 0.08 foot asphalt concrete blanket placed over one test section in 1966 and dropped from study. |
| 18) 06-Fre-1329-CR (64-6Y24C20-P) | One test section lost to canal construction in summer of 1966. |
| 19) 06-Fre-33 (60-6TC13-FP) | Seal coat placed in summer of 1967 and project dropped from study. |

Approximately ten newly completed projects were investigated for possible inclusion in this phase of the study but were eliminated from consideration due to low deflection levels. The Lane-Well's Dynaflect unit was used to great advantage in the selection or elimination of these test projects.

Table 1 presents the status of all projects remaining in this study and also the status of those which were eliminated at the time of elimination. Included is the range of surface distress for each project and also the traffic level which is defined in the subsequent discussion.

For all projects remaining in this study, deflection measurements and condition surveys are continuing on an annual basis. However, rut depth measurements in the wheel tracks are now only being obtained where rutting is obvious, since no changes in rut depths have occurred over the last few years on these projects. AC core samples are being taken every two years and a large backlog of data is accumulating on recovered asphalt properties.

As indicated in the last interim report, traffic information is only available to 1963. It was reported that a statewide traffic count would be made in 1966, unfortunately, however, no truck counts were included. During the interim, we programmed in the computer annual truck traffic count information beginning with the year 1950 and proceeding through 1963 on the majority of the projects under study. The program provided extrapolation of equivalent 5000 pound wheel loads (EWL) to year 1972 in terms of accumulative EWL for each year, from the date of completion to year 1972. Utilizing this data, the Traffic Indices (TI) to year 1968 were calculated and are presented in Table 1.

The level of distress on each roadway as shown by Table 1, was calculated in terms of surface area. Here the linear measurement of transverse and longitudinal cracks was weighted the same as the area of block cracking, according to the following equation:

$$\text{Distress (\%)} = \text{B(\%)} + \text{T(\%)} + \text{L(\%)}$$

Where:

$$B = \frac{\text{(Area of block cracking (ft)}^2}{\text{(Area of test section (ft)}^2} (100)$$

$$T = \frac{\text{(Linear ft. of transverse cracks)}}{\text{(Area of test section (ft)}^2} (1 \text{ ft.})(100)$$

$$L = \frac{\text{(Linear ft. of longitudinal cracks)}}{\text{(Area of test section (ft)}^2} (1 \text{ ft.})(100)$$

The values derived from this equation seem adequate in most cases for defining distress of pavements with flexible bases but appear as an over estimate of distress for roadways constructed with cement treated bases. For the latter, cracking is more closely related to shrinkage than to fatigue. Therefore, the equation for distress may be revised somewhat in final analyses.

A comparison between the 1968 data and that which was presented in the last interim report is shown on Figures 1 through 24. Here the change in asphalt properties, deflection levels and surface condition are presented for one test section per project. From this data, no clear cut trends or conclusions can be established. However, some preliminary computer analyses of data from one test section from each of five different Traffic Index-Deflection projects was performed. The results suggest that accumulative 5000 pound equivalent wheel loading was the most significant variable in contributing to surface distress. The second most important was the penetration value of the recovered asphalt binder and thirdly important was the pavement deflection. Since this was only a trial run, it may have little bearing on final results and conclusions, when all data is considered.

DEFLECTION ATTENUATION

During the interim period, follow-up deflection measurements were made over 16 different projects constructed subsequent to deflection study. Since the last reporting 177 different city, county and state roadways totaling over 500 centerline miles have been subject to deflection study for purposes of determining reconstruction and maintenance requirements. Appropriate reconstruction was recommended based on present deflection criteria.

Recently a computer analyses was performed on all deflection attenuation data thus far collected. The results indicated the deflection attenuation design criteria is still valid.

RADIUS OF CURVATURE

Another area of study that is continuing, consists of the determination and analysis of the area of influence or radius of curvature of a pavement under load, and the relationship of this variable to pavement performance. For this the Dehlen "curvature meter" device is being used to collect data on all projects which are subject to deflection measurement.

Correlation curves relating radius of curvature to pavement deflection for both cement treated and untreated aggregate base construction have been established by computer analyses. The results reveal a coefficient of correlation of 0.73 for the untreated

base sections and 0.84 for the cement treated base sections. The standard error of the estimate in terms of Benkelman beam deflection was found to be ± 0.008 inch for the untreated base sections and ± 0.007 inch for cement treated base sections. This suggests, it is possible to estimate the deflection level of a particular roadway by means of radius of curvature measurements.

PAVEMENT PERFORMANCE PHASE

This phase of the study has involved visual inspection of mainline AC pavements which have been constructed since 1961 and have been in service at least three years, the purpose of which is to evaluate present design standards and accumulate detailed information related to the effectiveness of construction methods and materials used in highway construction throughout the State of California. To gain information on different projects, District Maintenance Engineers and Area Maintenance Superintendents are first contacted and requested to report unusual or early distress which may be occurring on individual roadways. On projects where early distress is evident, an engineer from the Materials and Research Department will make a field review which will include photographs and condition surveys. From this, he will plan a test program. If fatigue cracking is observed, deflection measurements will then be obtained over representative test sections in cracked and uncracked areas. Detailed crack surveys and rut depth measurements will be made and AC core samples and samples of the other elements of the structural section will be obtained for testing.

Generally about 20 projects are reviewed each year but only three or less are actually tested. A log of projects is being kept and will be reviewed on an annual basis as new projects are added. If failures develop, testing will be initiated. Thus far, only a few projects have been tested as early failures are more or less non-existent.

REFERENCES

1. Zube, E., Forsyth, R. A. and Hannon, J. B., "An Interim Report on Statewide Follow-up Deflection Study of Overlays and Roadway Reconstruction", Research Report, Materials and Research Department, California Division of Highways, Sacramento, California, August 1966.

TABLE 1

STATUS OF TRAFFIC INDEX-DEFLECTION TEST PROJECTS
JULY 1968

| Project | Structural Section | Design (TI) | Year (TI) | Minimum Asphalt Properties by Absor Recovery 1968 Penetration(mm) | Ductility(cm) | Mean Deflection level range 1968 (inches) | Range of Distress in Percent (%) |
|-----------------------------------|---|-------------|-----------|---|---------------|---|----------------------------------|
| 1) 03-Col-45 (61-3T13C20) | 0.25'AC 0.50'AB 0.83'AS | 6.1 | 6.8 | 10 | 6 | 0.013 to 0.030 | 0 to 5.1 |
| 2) 03-Gle-162 (60-14TC22-F) | 0.25'AC 0.50'AB 0.75'AS | 7.9 | 6.9 | 12 | 8.5 | 0.011 | 0.5 |
| 3) 03-Gle-162 (64-14T13C6) | 0.30'AC 0.50'AB 1.08'AS | 7.0 | 6.5(67) | 32 | 100+ | 0.011 to 0.012 | nil |
| 4A) 03-Sac-99 (60-3TC20) | 0.30'AC 0.67'CTB Exist. Pmnt. | 8.0 | 8.8 | 17 | 100+ | 0.001 to 0.003 | 0.2 to 9.4 |
| 4B) 03-Sac-99 (61-3TC9) | 0.55'AC 0.50'AB Exist. Pmnt. | 8.0 | 8.7 | 20 | 100+ | 0.011 & 0.016 | 0.3 |
| 4C) 03-Sac-99 (61-3TC9) | 0.30'AC 1.00'AB Exist. Pmnt. | 8.0 | 8.7 | 18 | 100+ | 0.011 to 0.015 | nil |
| 5) 03-Yol-99 (61-3T13C31) | 0.29'AC 0.67'AB 1.17'AS | 8.5 | 8.2 | 13 | 5 | 0.011 to 0.016 | 0.5 to 2.5 |
| 6) 04-Nap-121,29 (62-4T13C5-F) | 0.25'AC 0.67'CTB 1.50'AS | 8.2 | 8.0 | 32 | 100+ | 0.001 to 0.019 | 0.2 to 3.0 |
| 7) 05-Mon-101 (62-5T13C3-F) | 0.36'AC 0.25'ACB 0.50'AB 1.25'AS | 9.3 | 9.5 | 22 | 70 | 0.007 to 0.013 | nil |

TABLE 1 (CON'T)

STATUS OF TRAFFIC INDEX-DEFLECTION TEST PROJECTS
JULY 1968

| Project | Structural Section | Design (TI) | Year (TI) | Minimum Asphalt Properties by Abson Recovery Penetration(mm) | Ductility(cm) | Mean Deflection level range 1968 (inches) | Range of Distress in Percent (%) |
|------------------------------|---|-------------|-----------|--|---------------|---|----------------------------------|
| 8) 05-Mon-101 (60-14TC1-F) | 0.59'AC 0.50'AB 0.92'AS | 9.0 | 10.0 | 26 | 100+ | 0.004 to 0.011 | 0 to 5.8 |
| 9) 05-Mon-101 (62-5T13C4) | 0.25'AC 0.67'CTB 0.75'AS | 8.3 | 9.3(67) | 23 | 64 | 0.002 to 0.009 | 2.5 to 9.2 |
| 10) 05-SBT-246 (61-5V13C9) | 0.31'AC 0.50'AB | 7.9 | 6.5 | 23 | 14 | 0.011 to 0.029 | 2.3 to 4.1 |
| 11) 05-SBT-156 (62-5T13C2) | 0.31'AC 0.67'AB 1.00'AS | 7.9 | 8.4 | 30 | 100+ | 0.010 to 0.012 | 0 to 1.8 |
| 12) 05-SBT-156 (61-5TC3) | 0.31'AC 0.50'CTB 0.17'AB 0.75'AS | 7.3 | 8.4 | 27 | 100+ | 0.001 to 0.002 | 2.8 to 5.2 |
| 13) 05-SL0-1 (61-5V13C12) | 0.27'AC 0.67'AB 1.00'AS | 7.7 | 6.8 | 21 | 31 | 0.007 to 0.022 | nil |
| 14) 06-Ker-204 (64-6V13C2-F) | 0.29'AC 0.67'AB 0.83 to 1.04'AS | 8.2 | 7.7 | 18 | 100+ | 0.017 to 0.029 | 0 to 2.6 |
| 15) 06-Kin-198 (62-6T13C4) | 0.25'AC 0.50'CTB 0.67'AS 0.33'IB | 7.9 | 7.7 | 23 | 26 | 0.004 to 0.021 | 2.6 to 14.6 |

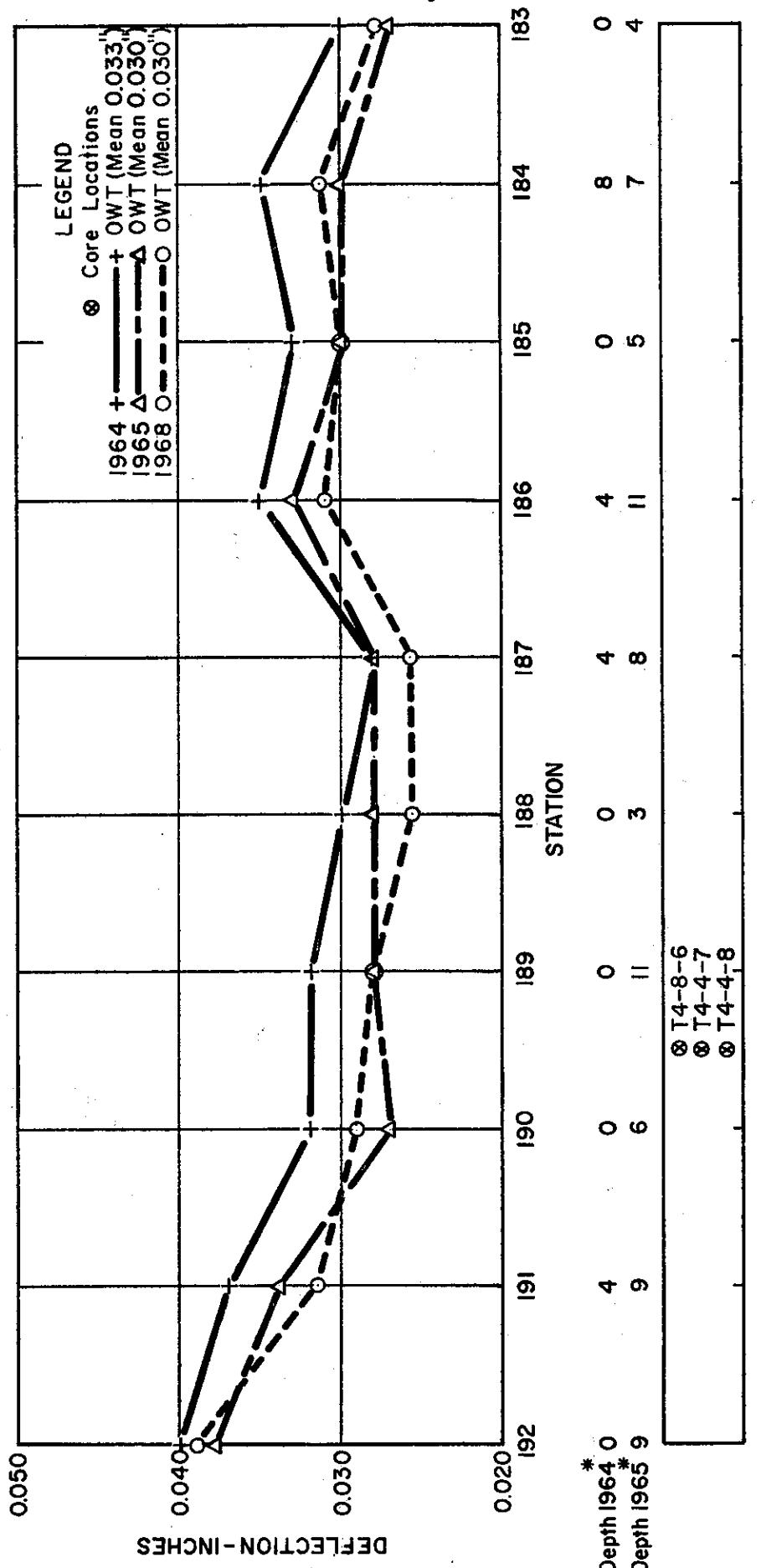
TABLE 1 (CON'T)

STATUS OF TRAFFIC INDEX-DEFLECTION TEST PROJECTS
JULY 1968

| Project | Structural Section | Design (TI) | Year 1968 (TI) | Minimum Asphalt Recovery by Absorbed Penetration(mm) | Properties Ductility(cm) | Mean Deflection level range 1968 (inches) | Range of Distress in Percent (%) |
|-----------------------------------|---|-------------|----------------|--|--------------------------|---|----------------------------------|
| 16) 06-Kin-Tul-43 (63-6TC13C2-P) | 0.25'AC 0.50'CTB Exist. Pavmt. | 7.5 | 6.8 | 14 | 100+ | 0.001 to 0.005 | 0.5 to 12.5 |
| 17) 06-Fre-811-CR (64-6Y24C19-P) | 0.25'AC 0.50'AB 1.17'AS | --- | --- | 13 | 1 | 0.022 to 0.026 | 0 to 0.2 |
| 18) 06-Fre-1329-CR (64-6Y24C20-P) | 0.25'AC 0.50'AB 0.92' to 1.00'AS | --- | --- | 12 | 1 | 0.012 to 0.024 | 0.1 to 0.4 |
| 19) 06-Fre-33 (60-6TC13-FP) | 0.29'AC 0.50'AB 1.21'AS | 7.5 | 7.0 | 12 | 7 | 0.020 to 0.030 | 0 to 1.6 |
| 20) 10-Cal-49 (64-10T13C14) | 0.25'AC 0.50'AB 1.00'AS | 7.0 | 5.9 | 23 | 100+ | 0.021 to 0.031 | nil |
| 21) 10-Sol-680 (60-10TC18-FI) | 0.39'AC 0.67'CTB 1.00'ISM 1.00'Per.Mat1. | 8.7 | 7.2 | 14 | 14 | 0.002 to 0.008 | 0 to 3.2 |
| 22A) City of Woodland | 0.17'AC 0.50'AB 0.G. | --- | --- | --- | -- | 0.029 to 0.034 | 0 to 1.7 |
| 22B) City of Woodland | 0.33'AC 0.G. | --- | --- | --- | -- | 0.026 | nil |

PROJECT 1
03-C01-45
CONT. 6I-3T13C20
SOUTHBOUND LANE

Figure 1

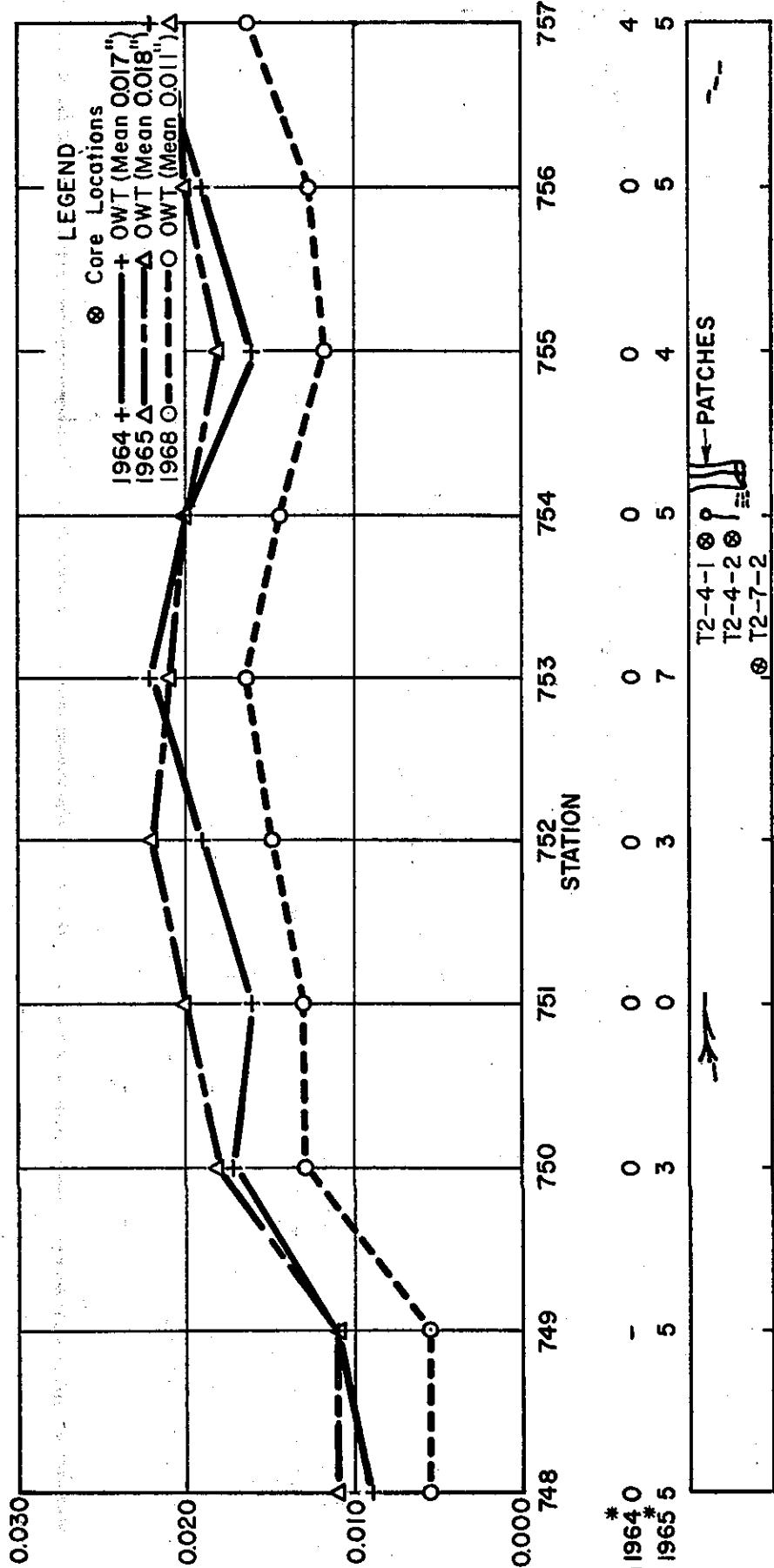


** Core Designation (Center number indicates year sampled)

| STRUCTURAL SECTION | |
|--------------------|------------------|
| 0.25' AC | Completed 9/6/61 |
| 0.50 AB | |
| 0.83' AS | |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 2
03 - 618 - 162
CONT. 60-14TC22-F
EASTBOUND LANE



Rut Depth 1964* 0
Rut Depth 1965* 5

**Core Designation (Center number indicates year sampled).

TEST DATA

| | T2-4-1 | T2-4-2 | T2-7-2*** |
|--------------------|--------|--------|-----------|
| % Asphalt | 3.9 | 4.3 | 4.4 |
| Pen. at 77°F | 22 | 14 | 12 |
| S.P. (F°) | 149 | 155 | 157 |
| Duct. at 77°F (Cm) | 41.5 | 9.8 | 8.5 |

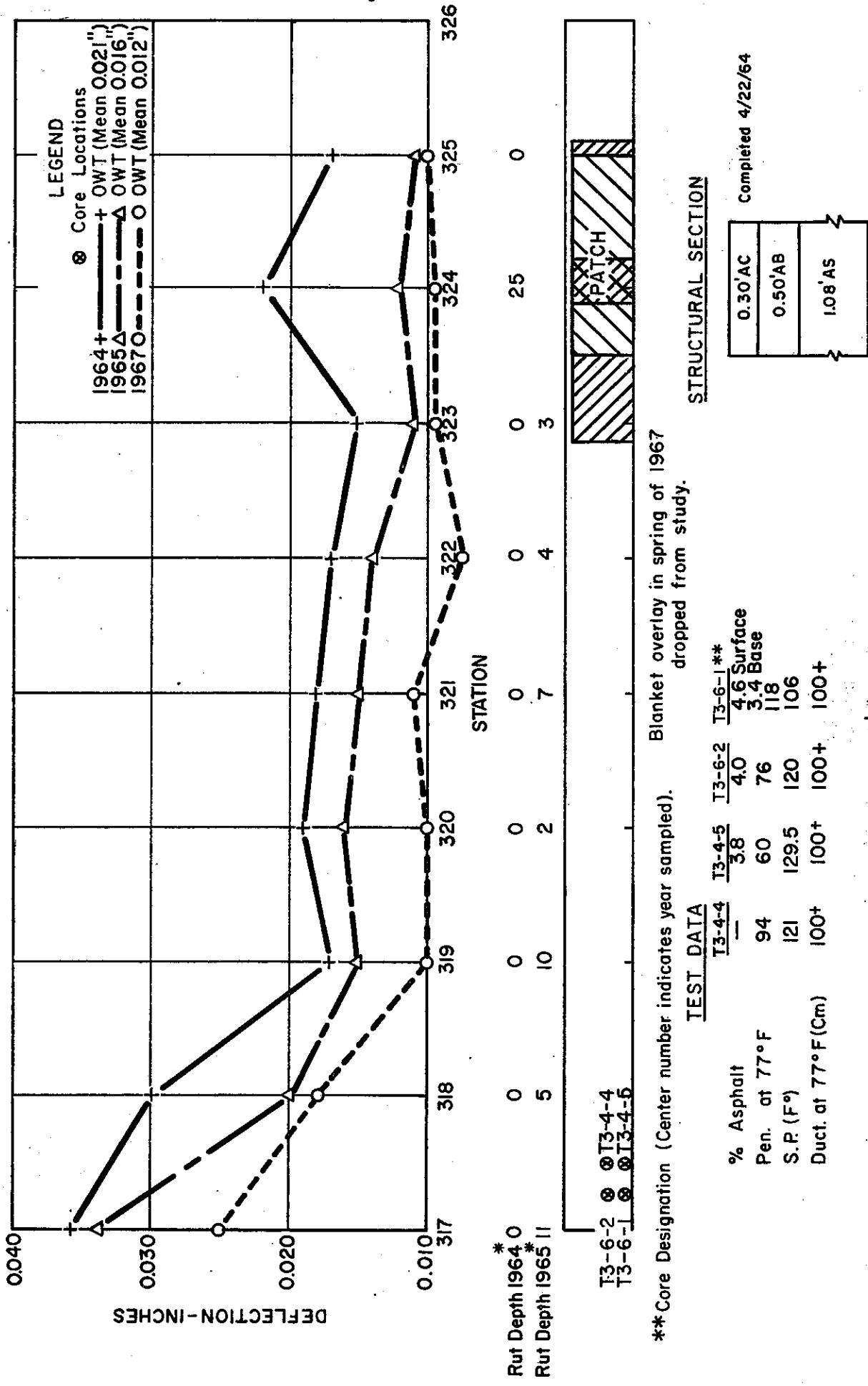
STRUCTURAL SECTION

| | |
|----------|------------------|
| 0.25' AC | Completed 6/5/61 |
| 0.50' AB | |
| 0.75' AS | |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 3
03-610-162
CONT. 64-14T13C6
EASTBOUND LANE

Figure 3



PROJECT 4A
03-Sac-99
CONT. 60-3TC-20
SOUTHBOUND LANE

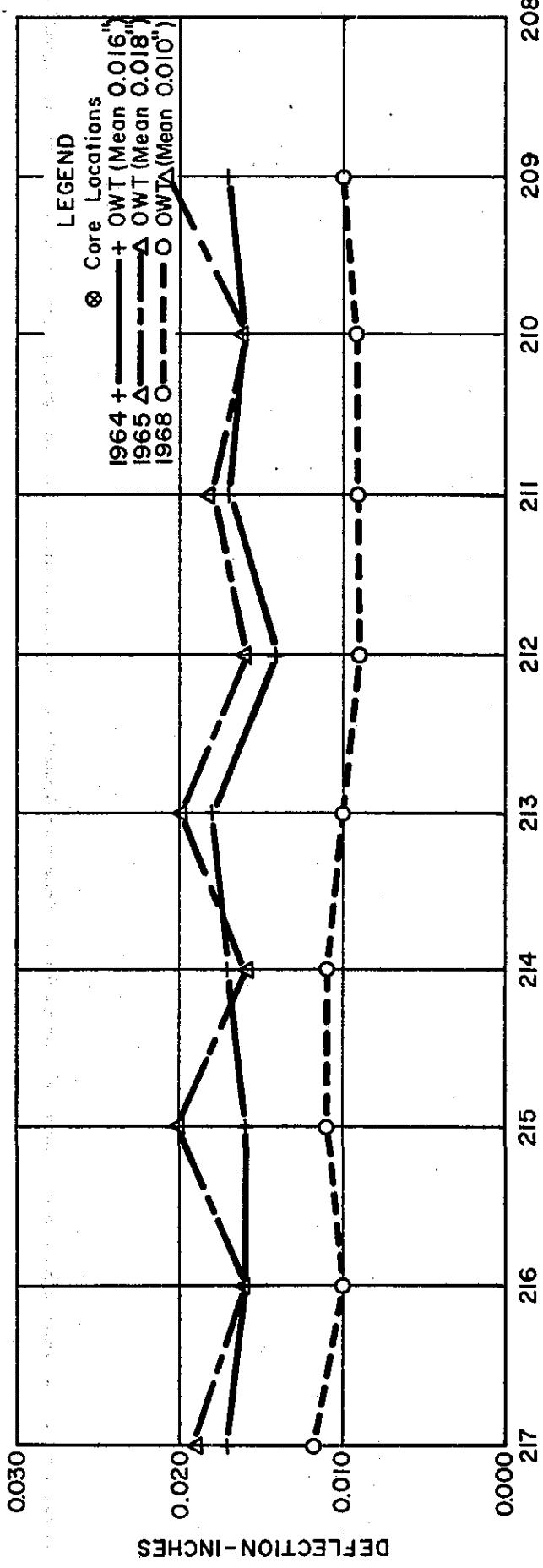


Figure 4

**Core Designation (Center number indicates year sampled).

| | |
|-------|---------|
| PATCH | T7-4-23 |
| O | T7-8-11 |

STRUCTURAL SECTION

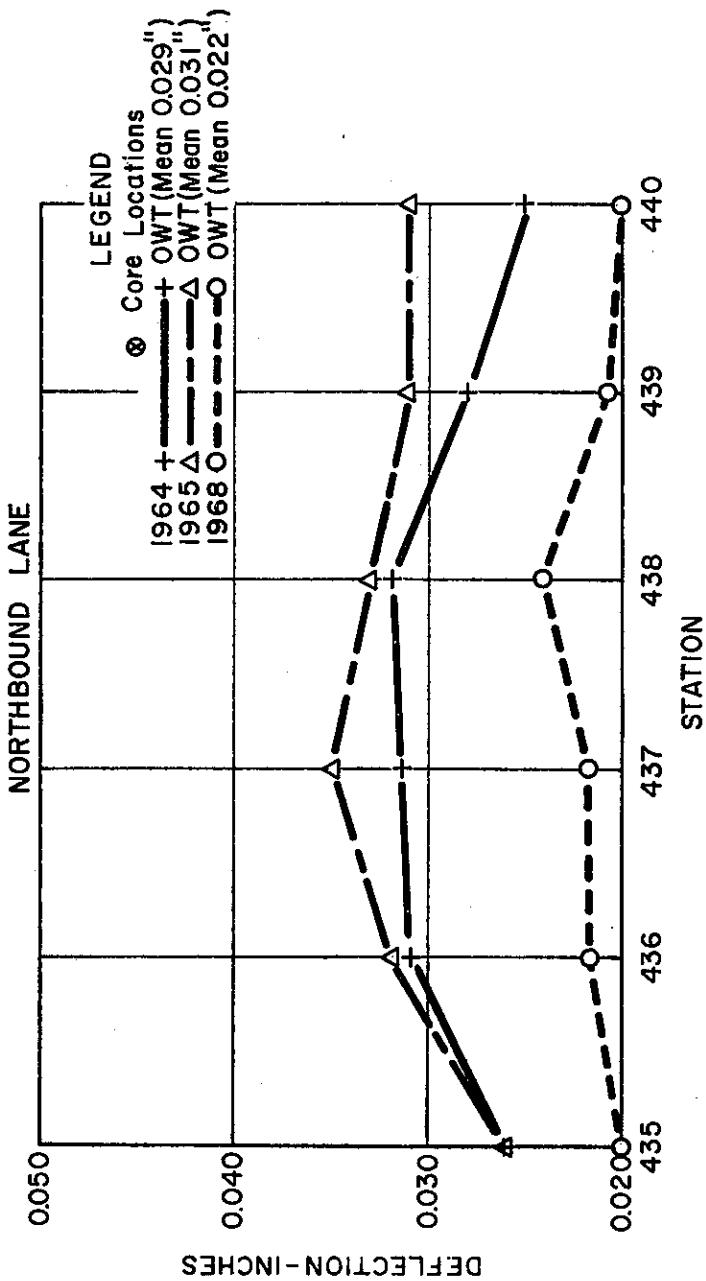
| | |
|--------------|--------------------|
| 0.3' AC | Completed 10/22/59 |
| 0.67' CTB | |
| Old Pavement | |

TEST DATA

| | T7-4-23 | T7-8-11** |
|--------------------|---------|-----------|
| % Asphalt | 5.2 | 5.7 |
| Pen. at 77°F | 24 | 19 |
| S.P (F°) | 139.5 | 144 |
| Duct. at 77°F (Cm) | 100+ | 100+ |

Figure 5

PROJECT 4B
03-Sac-99
CONT. 6I-3TC9



| Rut Depth 1965* | 5 | 9 | 11 | 13 | 11 |
|-----------------|---|---|----|----------|----|
| | | | | ⑧ T7-4-7 | |
| | | | | ⑧ T7-8-3 | |
| | | | | ⑧ T7-4-8 | |

TEST DATA

| | T7-4-7 | T7-4-8 | T7-8-3 |
|---------------------|--------|--------|--------|
| % Asphalt | 5.7 | 5.5 | 5.0 |
| Pen. at 77° F | 33 | 47 | 30 |
| S.P. (F°) | 138 | 127 | 137 |
| Duct. at 77° F (Cm) | 100+ | 100+ | 100+ |

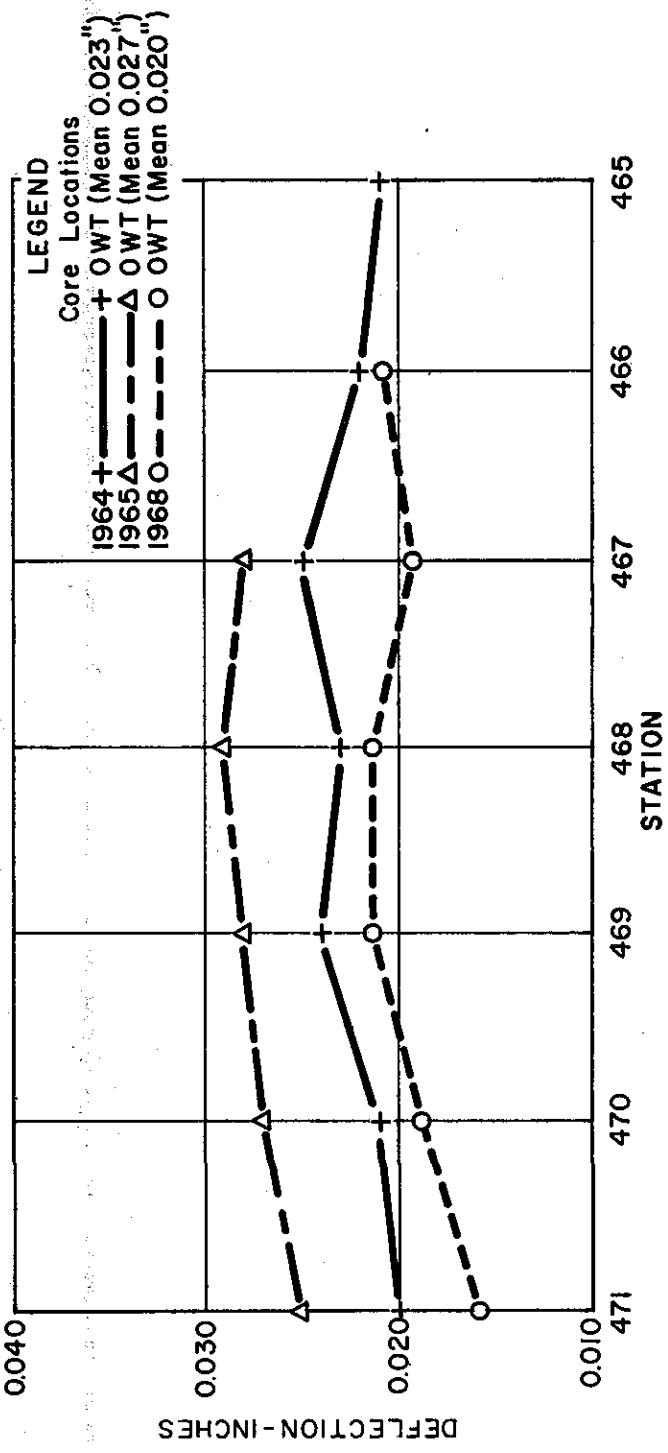
STRUCTURAL SECTION

| | | |
|--------|--------------|-------------------|
| TYPE B | 0.55AC | Completed 9/23/60 |
| | 0.50'AB | |
| | Old Pavement | |

* Measured to nearest 0.001" in outer wheel track.

Figure 6

PROJECT 4C
03-Sac-99
CONT. 61-3TC9
SOUTHBOUND LANE



Rut Depth 1965*

2 8 13 11 13 7

| | ⑧ T7-4-9 | ⑧ T7-8-1 | ⑧ T7-4-10 | TYPE B | 0.30'AC | STRUCTURAL SECTION |
|-------------------|----------|----------|-----------|--------|---------|--------------------|
| ⑧ | 4.2 | 5.4 | 4.7 | CI.2 | 1.00'AB | Completed 9/23/60 |
| ⑧ | 23 | 31 | 20 | | | |
| ⑧ | 148 | 142 | 149 | | | |
| Duct. at 77°F(Cm) | 58 | 100+ | 100+ | | | Old Pavement |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 5
03-Y01-99
CONT. 61-3T13C3I
SOUTHBOUND LANE

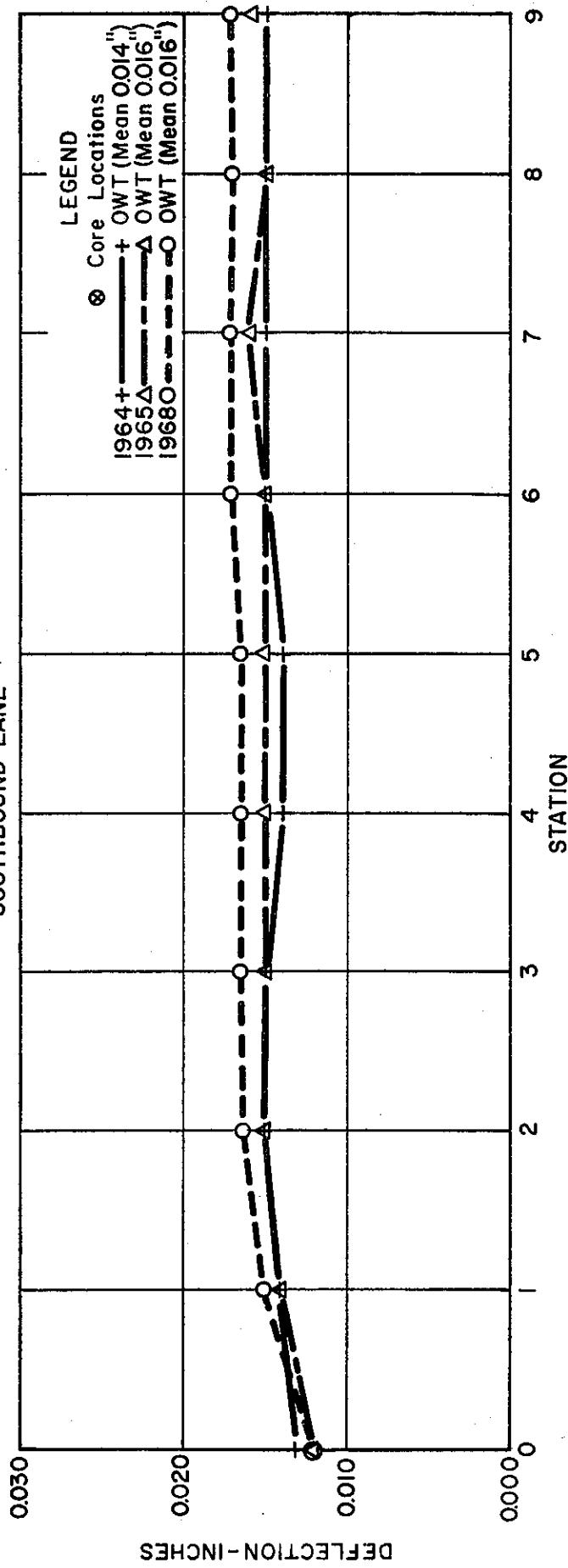
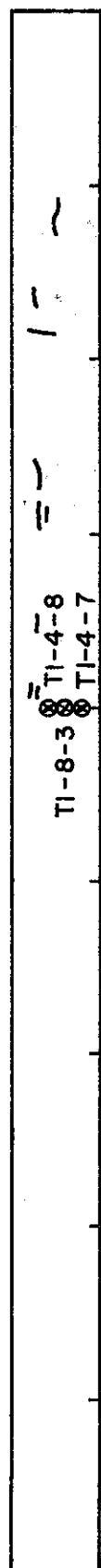
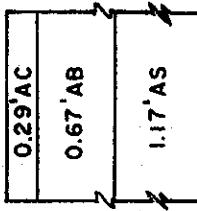


Figure 7



| TEST DATA | T1-4-7 | T1-4-8 | T1-8-3 |
|--------------------|--------|--------|--------|
| % Asphalt | 5.1 | 5.3 | 5.2 |
| Pen. at 77°F | 31 | 33 | 18 |
| S.P. (F) | 142.5 | 141 | 150 |
| Duct. at 77°F (Cm) | 100+ | 100+ | 20 |

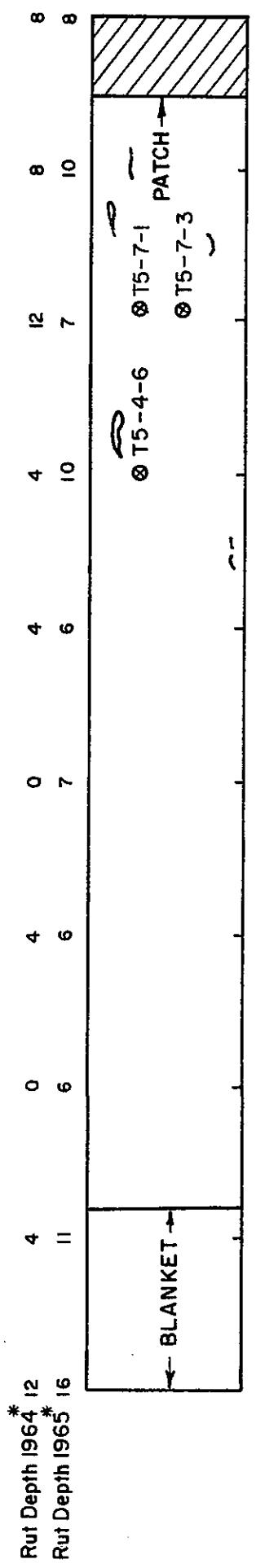
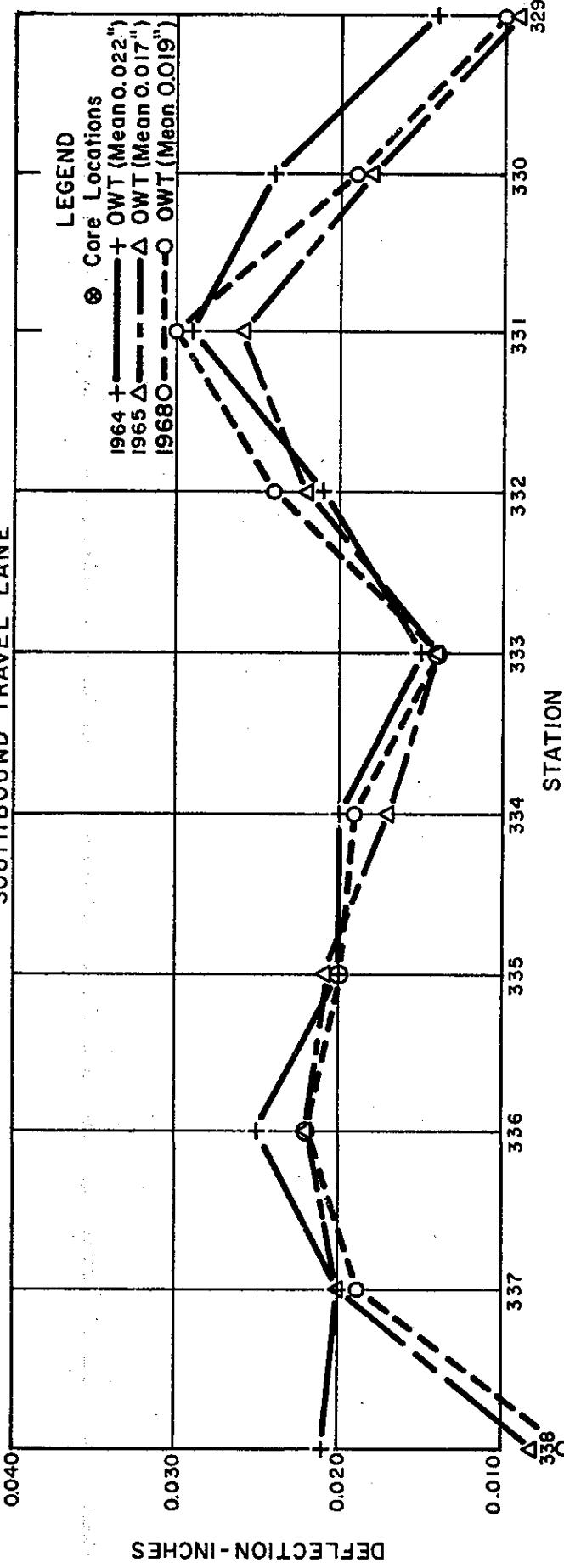
Completed 4/27/61



PROJECT 6

04-Nap-121,29
CONT. 62 - 4T13C5-E

SOUTHBOUND TRAVEL LANE



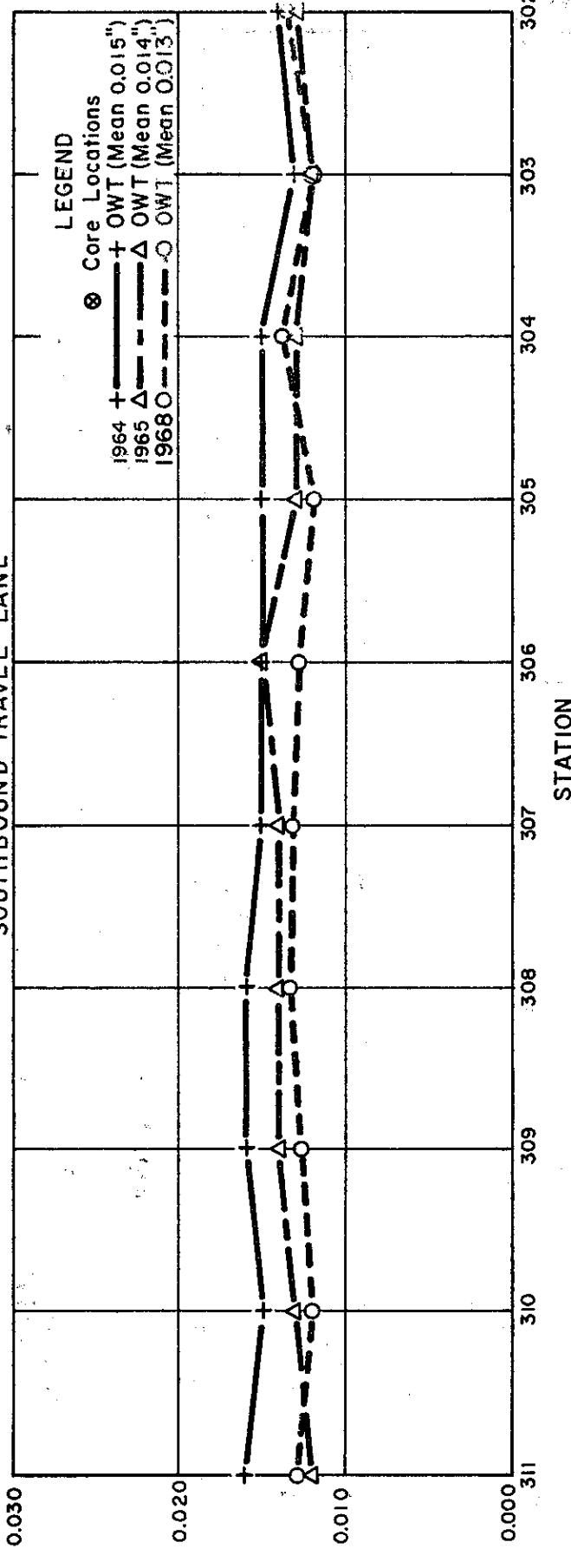
* Measured to nearest 0.001' in outer wheel track.

PROJECT 7

05 - Mon - 101

CONT. 62 - 5T13C3-F

SOUTH BOUND TRAVEL LANE



Rut Depth 1964 * 0
Rut Depth 1965 * 5

Figure 9



⊗ T13-4-9

⊗ T13-4-10
⊗ T13-8-7

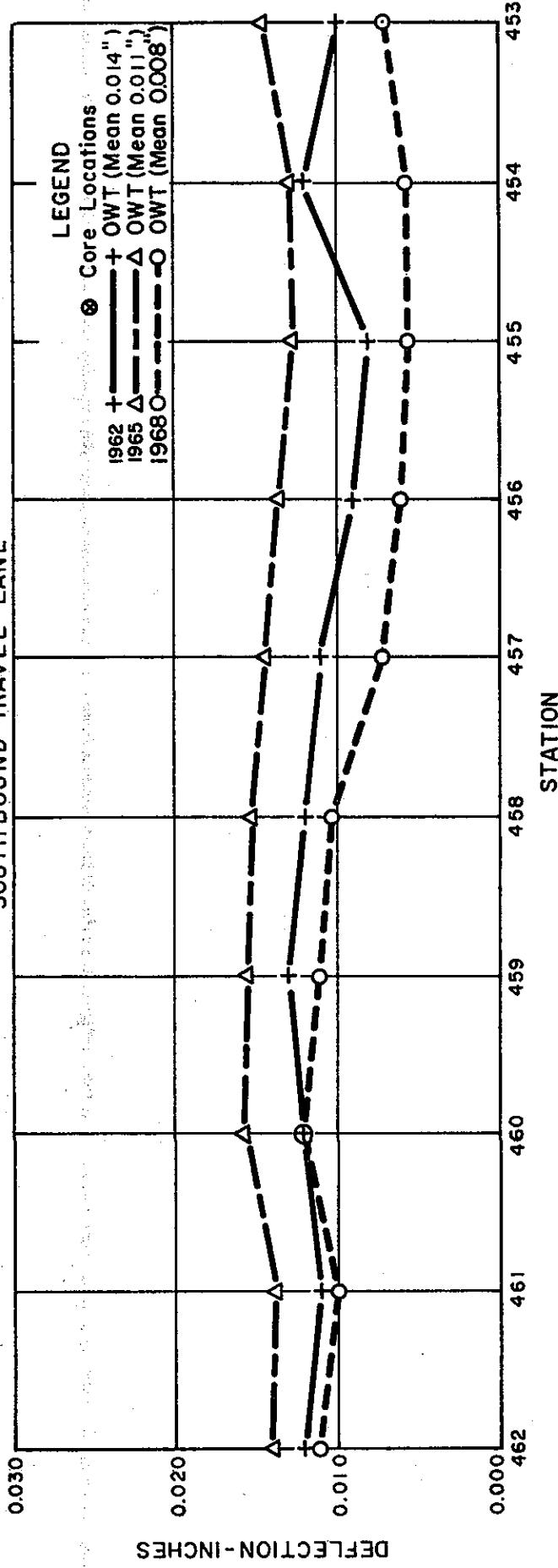
STRUCTURAL SECTION

| | |
|-----------|-------------------|
| 0.36' AC | Completed 7/16/63 |
| 0.25' ACB | |
| 0.50' AB | |
| 1.25' AS | |

* Measured to nearest 0.001" in outer wheel track.

PROJECT 8
05 - Mon - 10/
CONT. 60 - 14 TCI-F

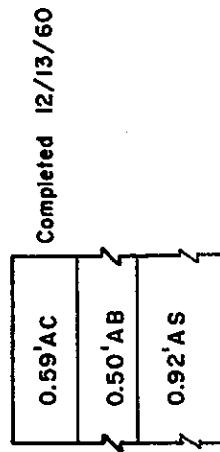
SOUTH BOUND TRAVEL LANE



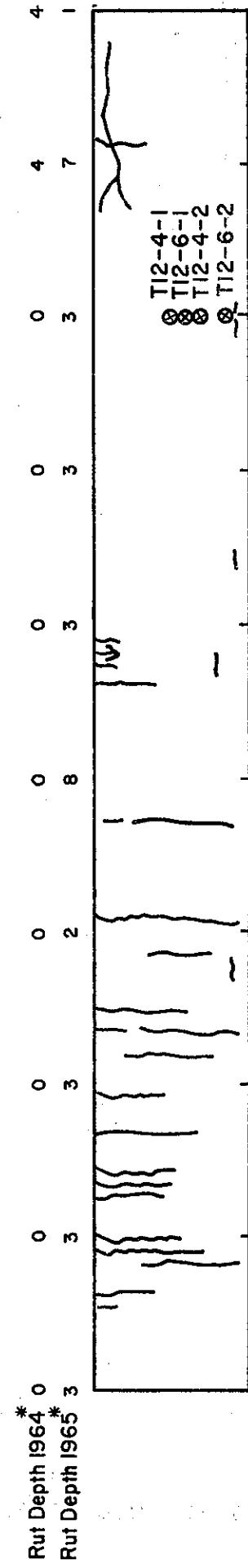
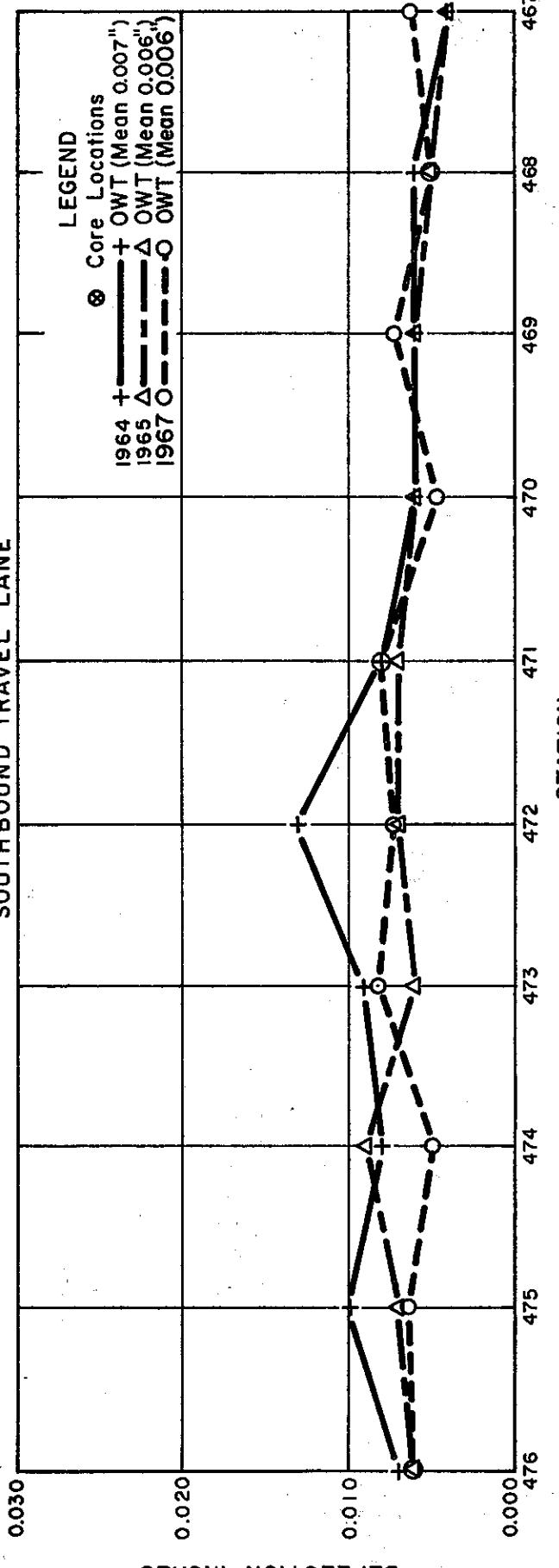
TEST DATA

| | T28-6-1 | T28-8-1 |
|--------------------|------------|------------|
| Surf. Base | Surf. Base | Surf. Base |
| % Asphalt | 4.9 | 5.2 |
| Pen. at 77°F | 35 | 57 |
| S.P. (F°) | 126 | 118 |
| Duct. at 77°F (Cm) | 100+ | 100+ |
| | 100+ | 100+ |

STRUCTURAL SECTION



PROJECT 9
 05 - Mon - 10
 CONT. 62 - 5T13 C4
 SOUTH BOUND TRAVEL LANE



Seal coat placed in April, 1968. Project dropped from study.

STRUCTURAL SECTION

| | T12-4-1 | T12-4-2 | T12-6-1 | T12-6-2 |
|--------------------|---------|---------|---------|---------|
| % Asphalt | 5.0 | 5.0 | — | — |
| Pen. at 77°F | 38 | 40 | 35 | 27 |
| S.P. (F°) | 142 | 139 | 143 | 149 |
| Duct. at 77°F (Cm) | 100+ | 100+ | 100+ | 100+ |

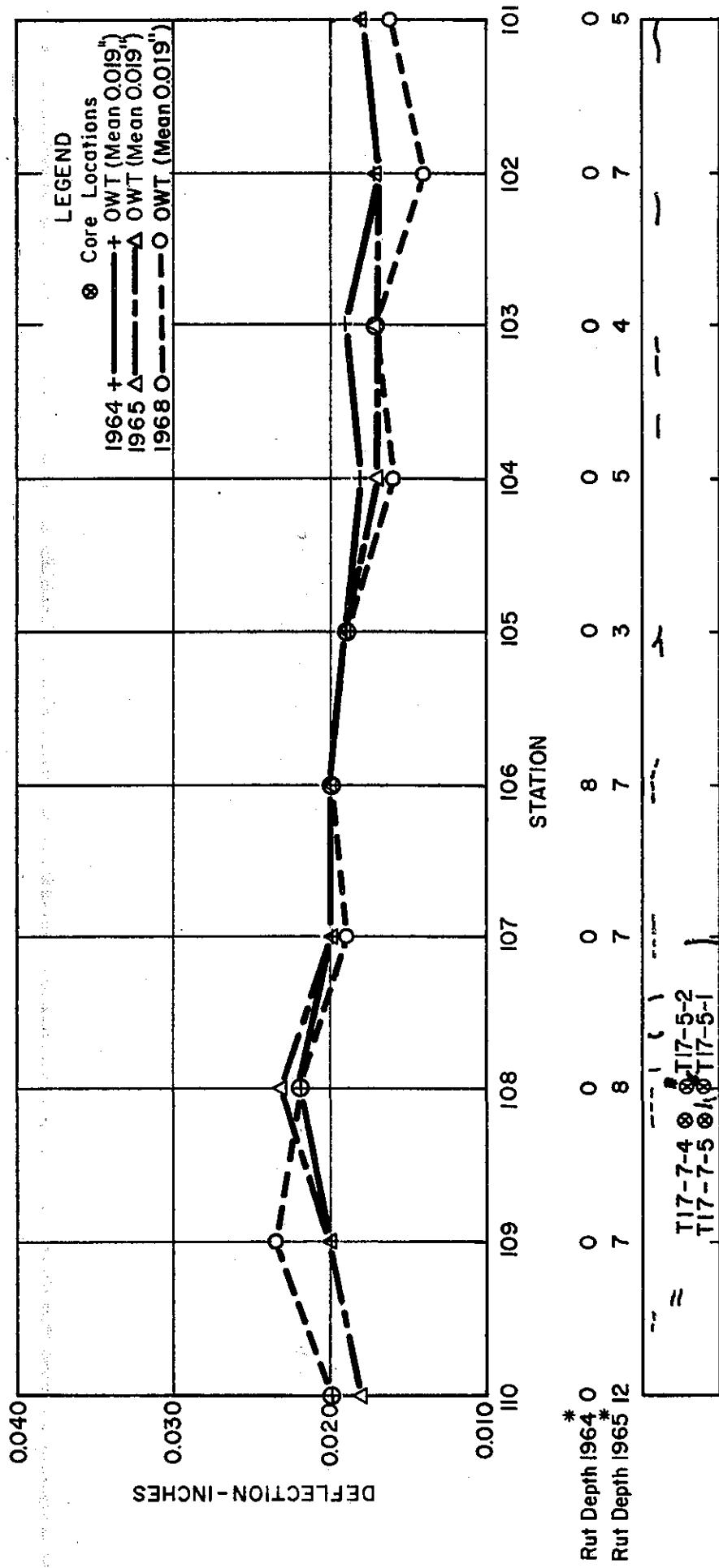
0.25' AC Completed 7/26/62

0.67' CTB

0.75' AS

* Measured to nearest 0.001 in outer wheel track.

PROJECT 10
05-SB-246
CONT. 61-5VI3C9
WESTBOUND LANE

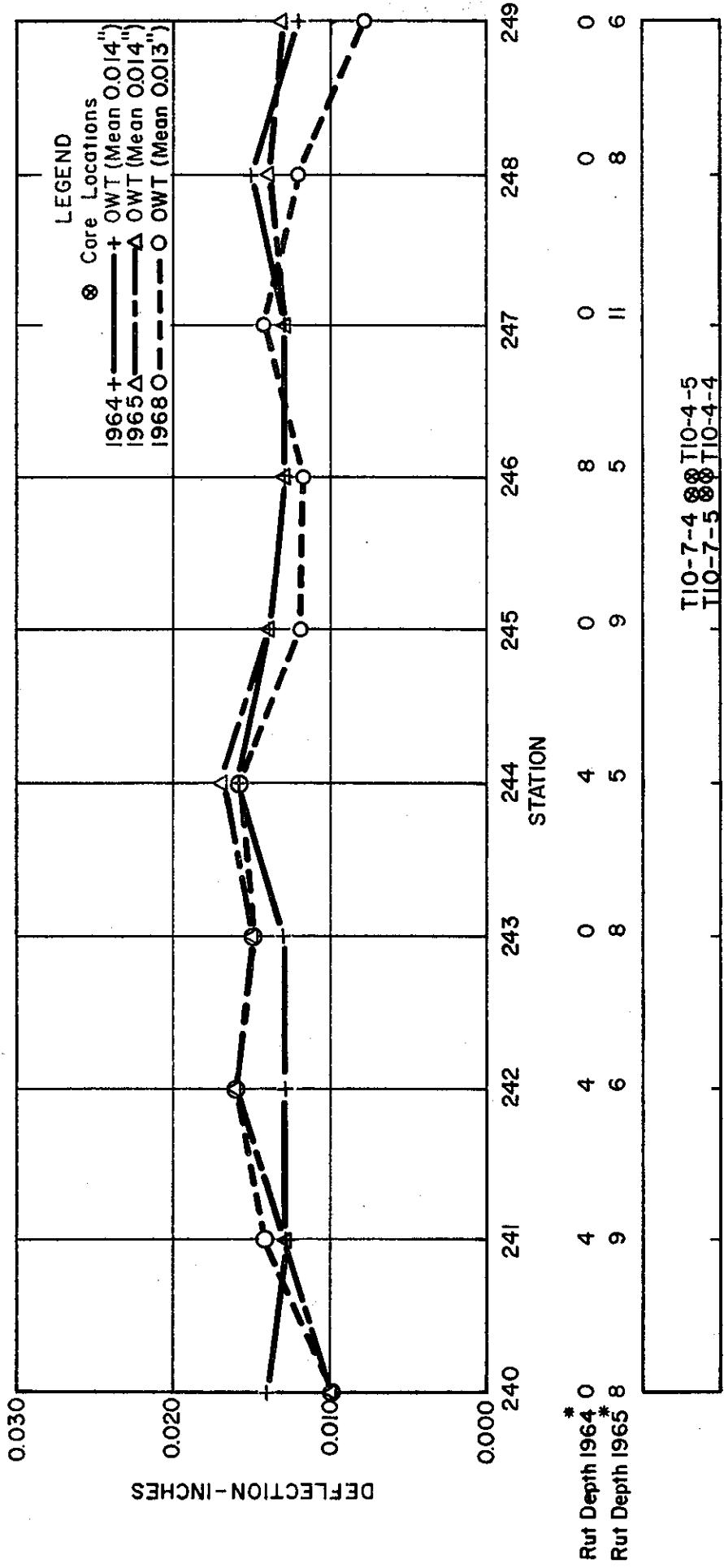


STRUCTURAL SECTION

| |
|-------------------|
| Completed 4/17/61 |
| 0.31' AC |
| 0.50' AB |
| Old Pavement |

* Measured to nearest 0.001' in outer wheel track.

PROJECT II
05- SBT-156
CONT. 62-5T13C2
EASTBOUND LANE



STRUCTURAL SECTION

| | |
|----------|------------------|
| 0.31' AC | Completed 1/4/62 |
| 0.67' AB | |
| 1.00' AS | |

TEST DATA

| % Asphalt | T10-4-4 | T10-4-5 | T10-7-4 | T10-7-5 |
|--------------------|---------|---------|---------|---------|
| Pen. at 77°F | 5.0 | 5.7 | 6.0 | 4.9 |
| S.P. (F°) | 28 | 32 | 38 | 29 |
| Duct. at 77°F (Cm) | 138 | 135 | 127.5 | 135 |
| | 100+ | 100+ | 100+ | 100+ |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 12
05-SBT-156
CONT. 61-5TC3
WESTBOUND LANE

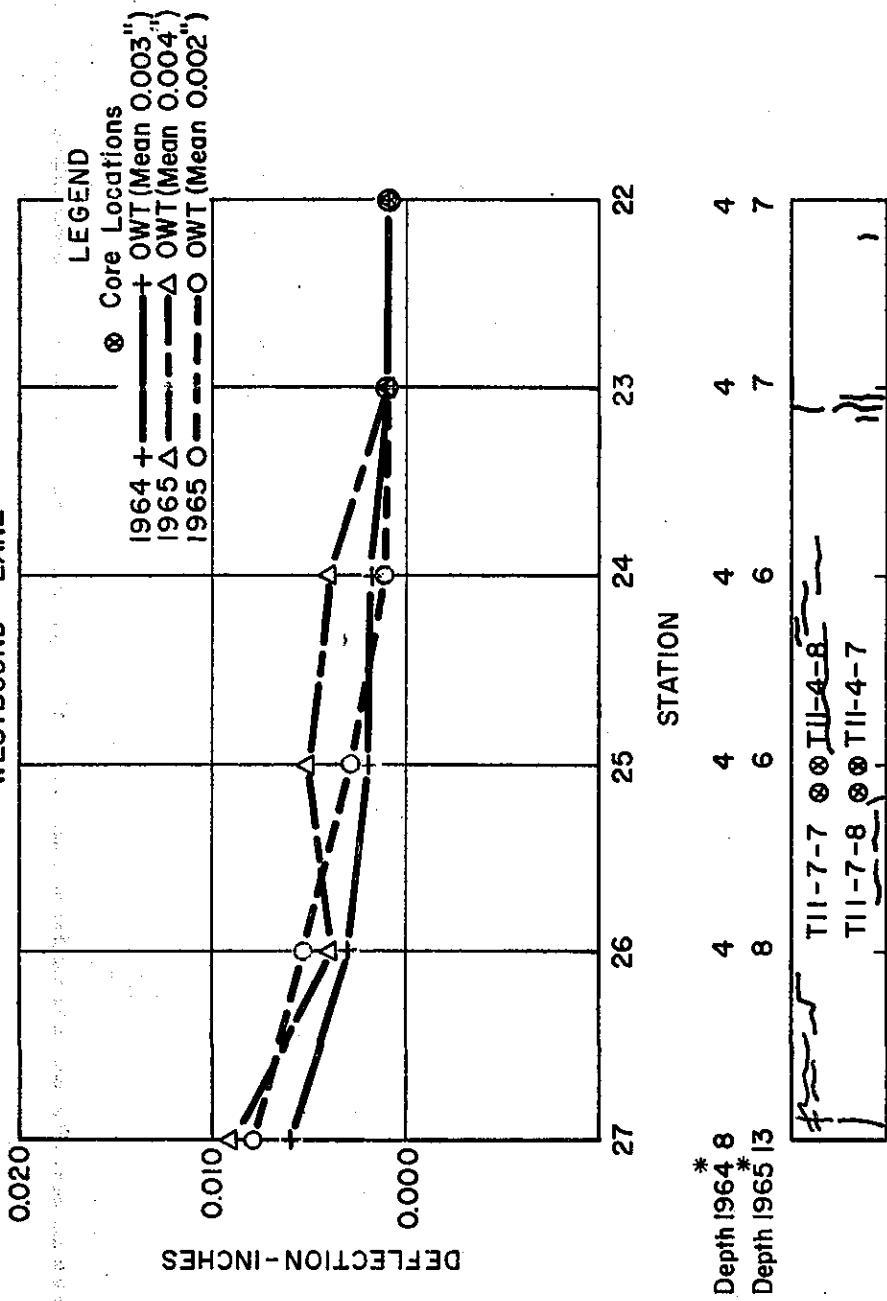


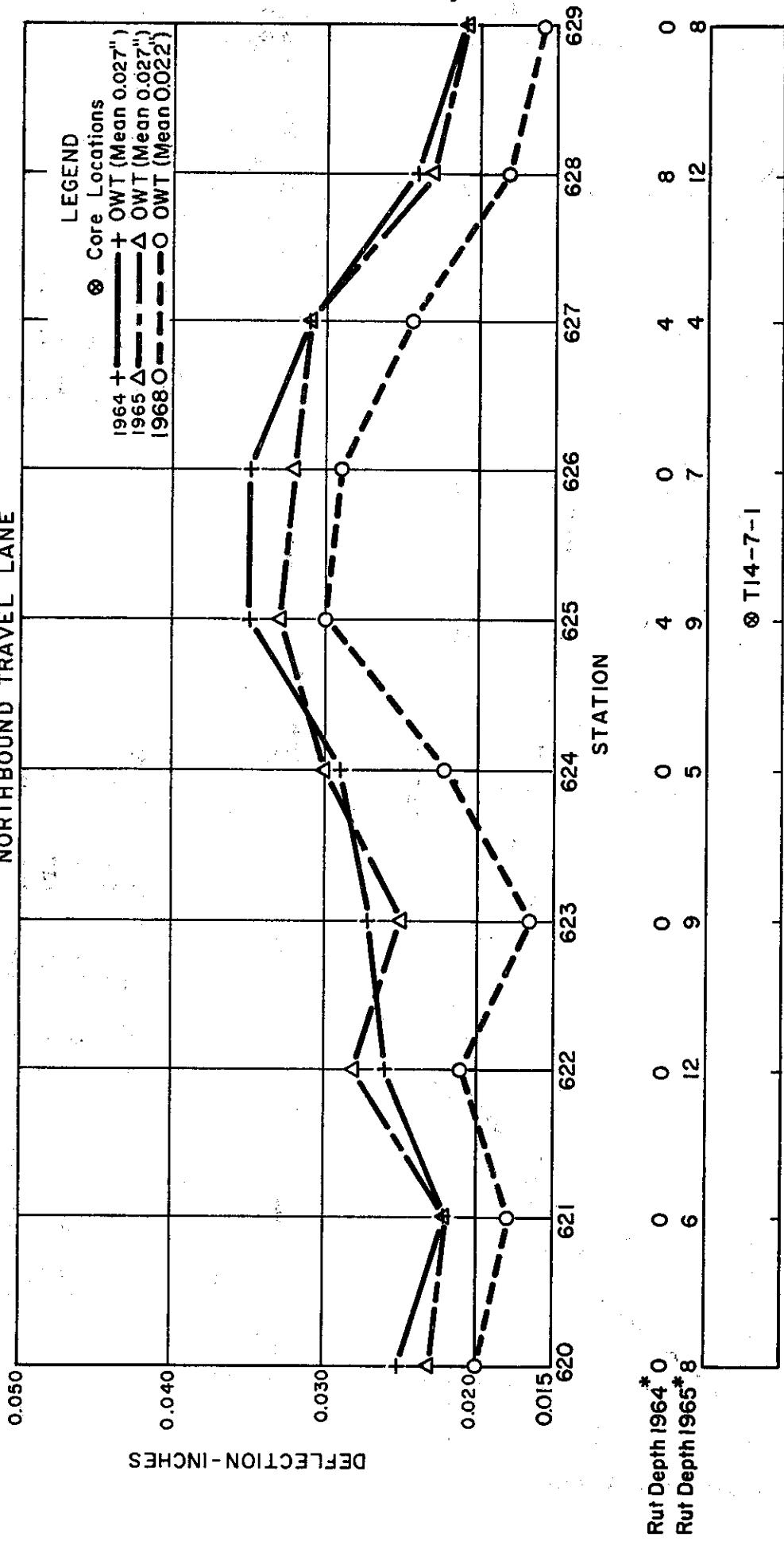
Figure 14

STRUCTURAL SECTION

| | |
|-----------|-----------------|
| 0.31' AC | Completed 6/5/6 |
| 0.50' CTS | |
| 0.17' AB | |
| 0.75' AS | |

PROJECT 13
05-SLO-1
CONT. 61 - 5V13 C12
NORTHBOUND TRAVEL LANE

Figure 15



* Measured to nearest 0.001' in outer wheel track.

Completed 8/15/63

% Asphalt 5.6
Pen. at 77°F 23
S. P (F°) 140
Duct. at 77°F (Cm) 100+

* Measured to nearest 0.001' in outer wheel track.

PROJECT 14

06-Ker-204

**CONT. 64-6V13C2-F
WESTBOUND TRAVEL LANE**

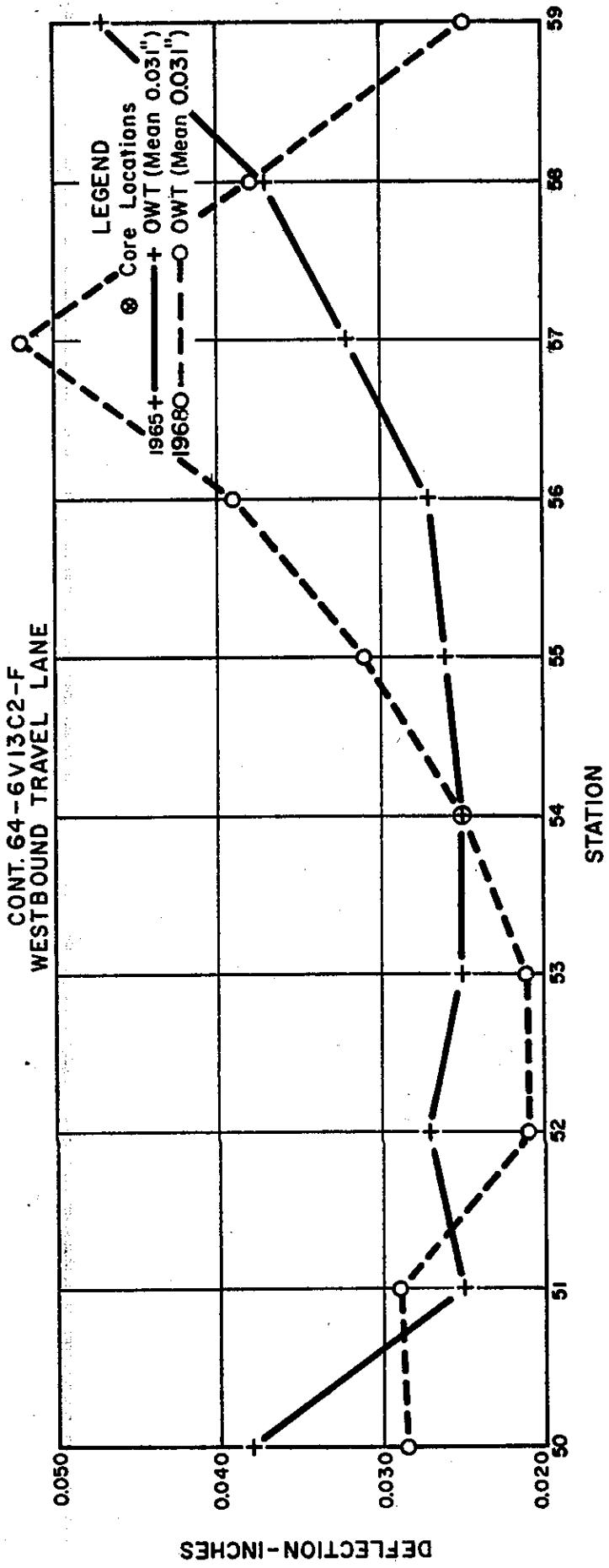
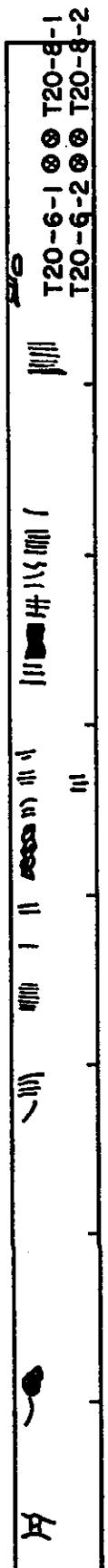


Figure 16

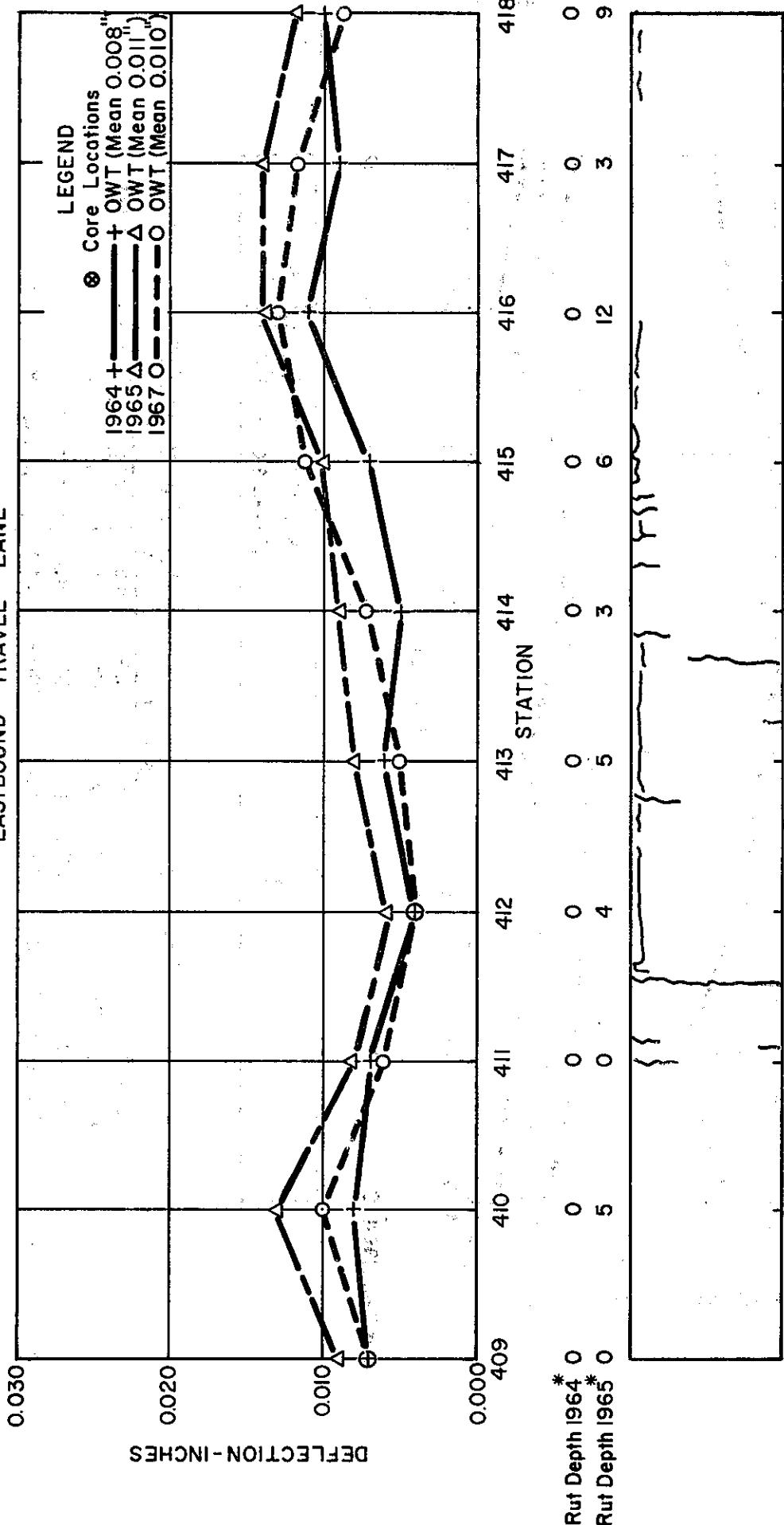


| | | | |
|-------------------|------|------|------|
| % Asphalt | — | — | — |
| Pen. at 77°F | 36 | 32 | 35 |
| S.P. (F°) | 129 | 132 | 130 |
| Duct at 77°F (Cm) | 100+ | 100+ | 100+ |

0.29' AC 0.67' AB 0.83' to 1.04' AS

PROJECT 15
 06-Kin - 198
 CONT. 62-6T13C4
EASTBOUND TRAVEL LANE

Figure 17



TEST DATA

| | T9-5** | T9-4** | T9-7-4** | T9-7-5** |
|--------------------|--------|--------|----------|----------|
| % Asphalt | 5.2 | 4.9 | 5.3 | 4.6 |
| Pen. at 77°F | 26 | 20 | 20 | 20 |
| S.P. (F°) | 145.5 | 153 | 152 | 150 |
| Duct. at 77°F (Cm) | 69 | 22.5 | 10.6 | 11 |

* Measured to nearest 0.001" in outer wheel track.

** Cores taken at Sta. 419

STRUCTURAL SECTION

| | |
|-----------|-------------------|
| 0.25' AC | Completed 6/26/63 |
| 0.50' CTB | |
| 0.67' AS | |
| 0.33' IB | |

PROJECT 16
06-Kin, Tul-43
CONT. 63-6T3C2-P
NORTHBOUND LANE

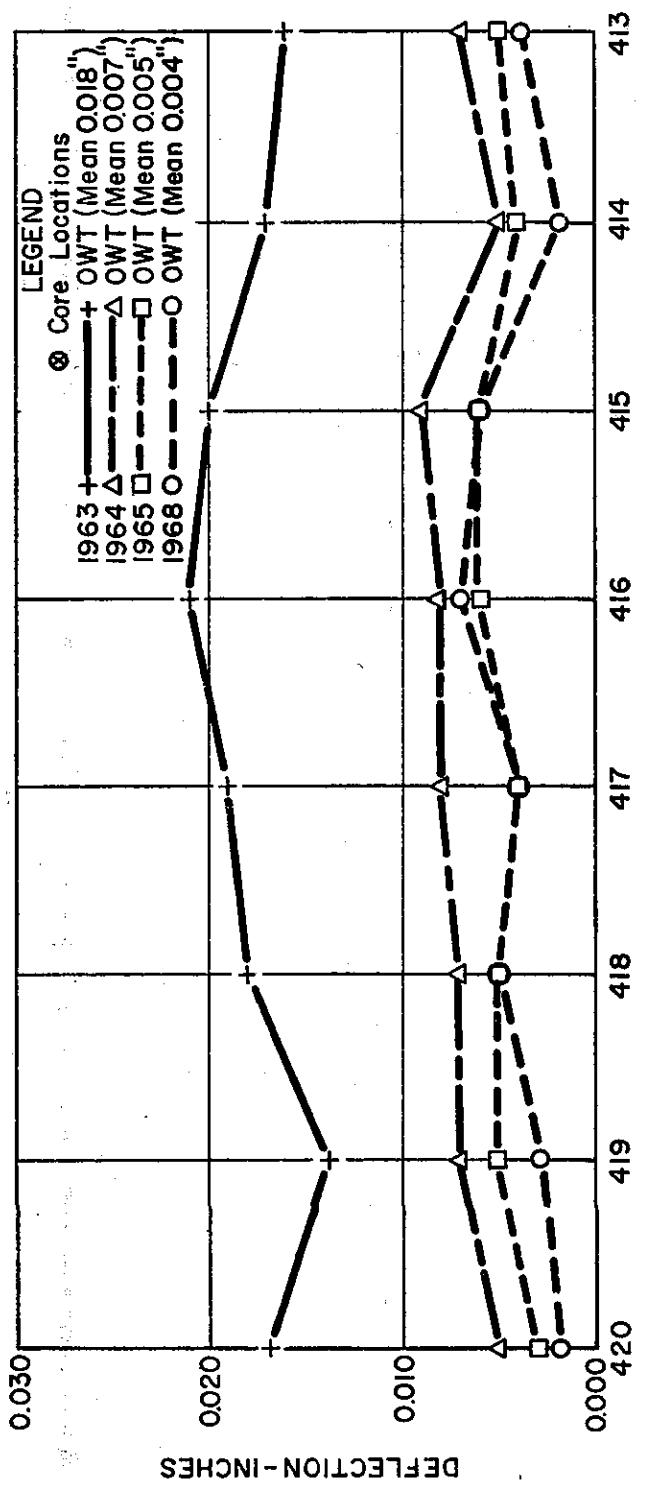


Figure 18

Rut Depth 1964 10
* Measured to nearest 0.001' in outer wheel track.

| TEST DATA | | T15-5-4 | T15-5-5 | T15-7-4 | T15-7-5 |
|--------------------|------|---------|---------|---------|--------------|
| % Asphalt | 51 | 5.0 | 4.9 | 4.8 | 0.25 AC |
| Pen. at 77°F | 22 | 24 | 17 | 14 | 0.5dCTB |
| S.P. (F) | 1395 | 138 | 137 | 140 | |
| Duct. at 77°F (Cm) | 100+ | 100+ | 100+ | 100+ | Old Pavement |

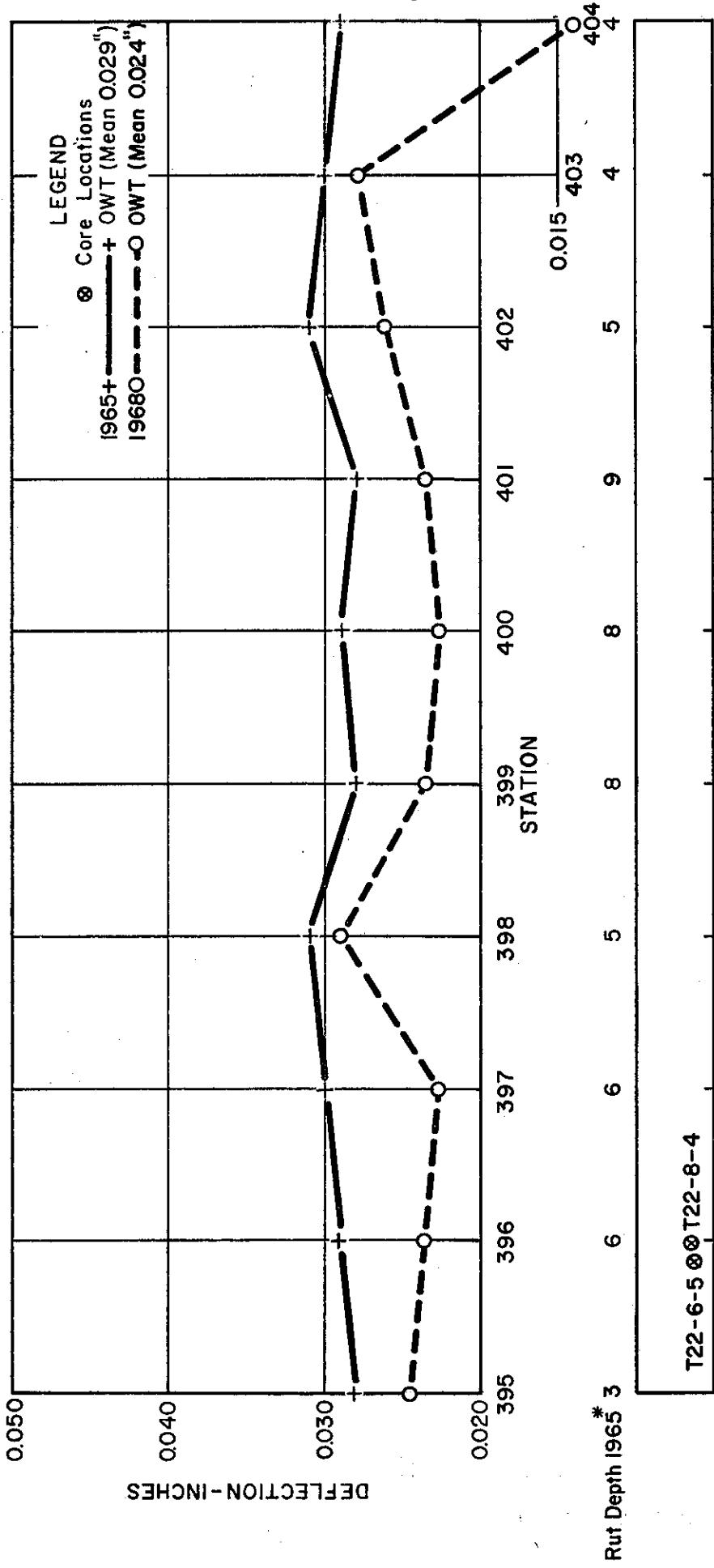
STRUCTURAL SECTION

| | | | | | |
|---------|---|---|---------|---|---|
| T15-7-4 | ④ | ④ | T15-5-5 | { | { |
| T15-7-5 | ④ | ④ | T15-5\4 | { | { |

| |
|------------------|
| Completed 2/4/63 |
| 0.25 AC |
| 0.5dCTB |
| Old Pavement |

Figure 19

PROJECT 17
06-Fre-8I-FAS
CONT. 64-6Y24C19-P
EASTBOUND LANE

TEST DATA

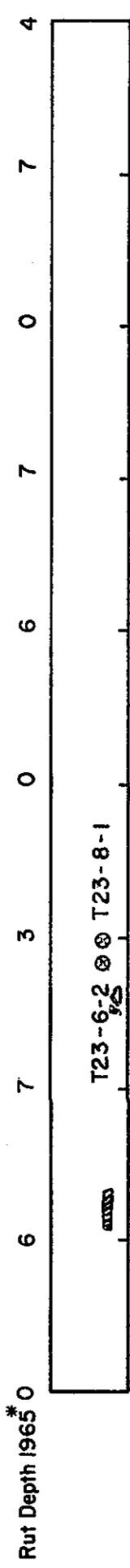
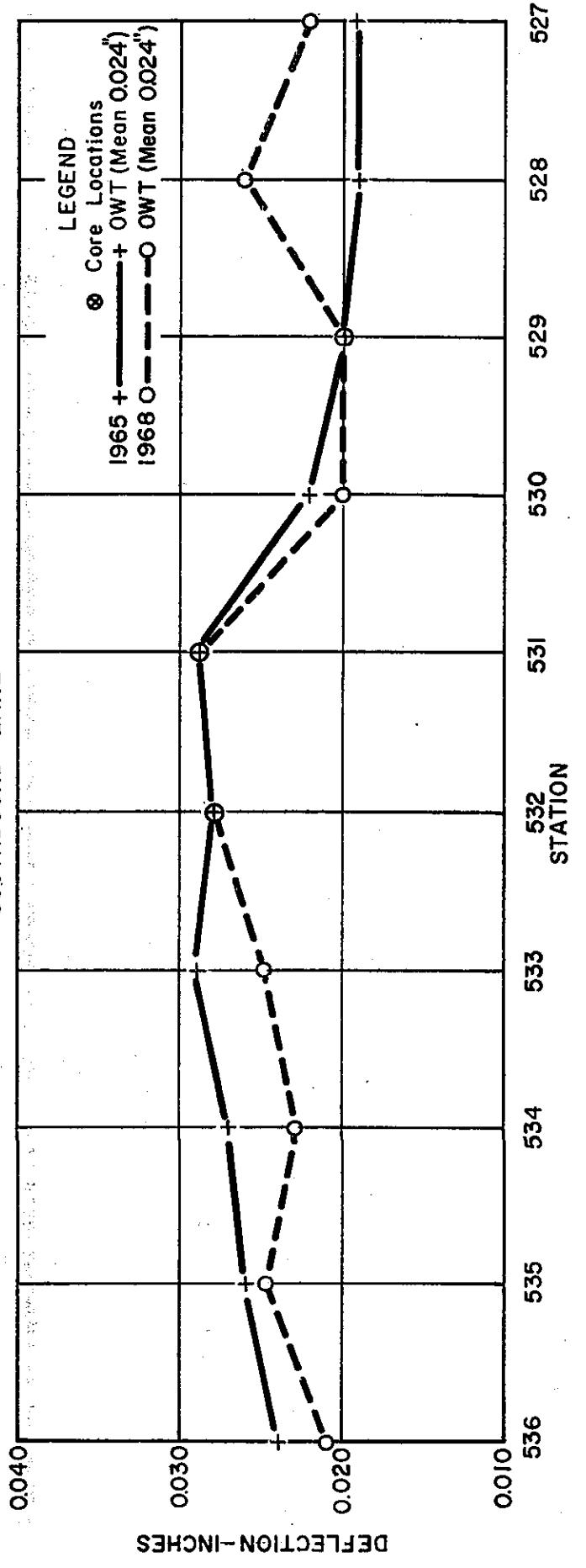
| | <u>T22-6-5</u> | <u>T22-8-4</u> |
|--------------------|----------------|----------------|
| % Asphalt | — | 5.0 |
| Pen. at 77°F | 15 | 17 |
| S.P. (F°) | 148 | 148 |
| Duct. at 77°F (Cm) | 100+ | 1 |

STRUCTURAL SECTION

| | |
|---------|-------------------|
| 0.25 AC | Completed 9/29/64 |
| 0.50 AB | |
| 1.17 AS | |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 18
06-Fre-1329-CR
CONT. 64-6Y24C20-P
SOUTHBOUND LANE.



STRUCTURAL SECTION

| | |
|----------------|-------------------|
| 0.25' AC | Completed 10/7/64 |
| 0.50' AB | |
| 0.92'-1.00' AS | |

* Measured to nearest 0.001' in outer wheel track.

PROJECT 19
06 - Fre - 33
CONT. 60-6TC13-FP
SOUTHBOUND LANE

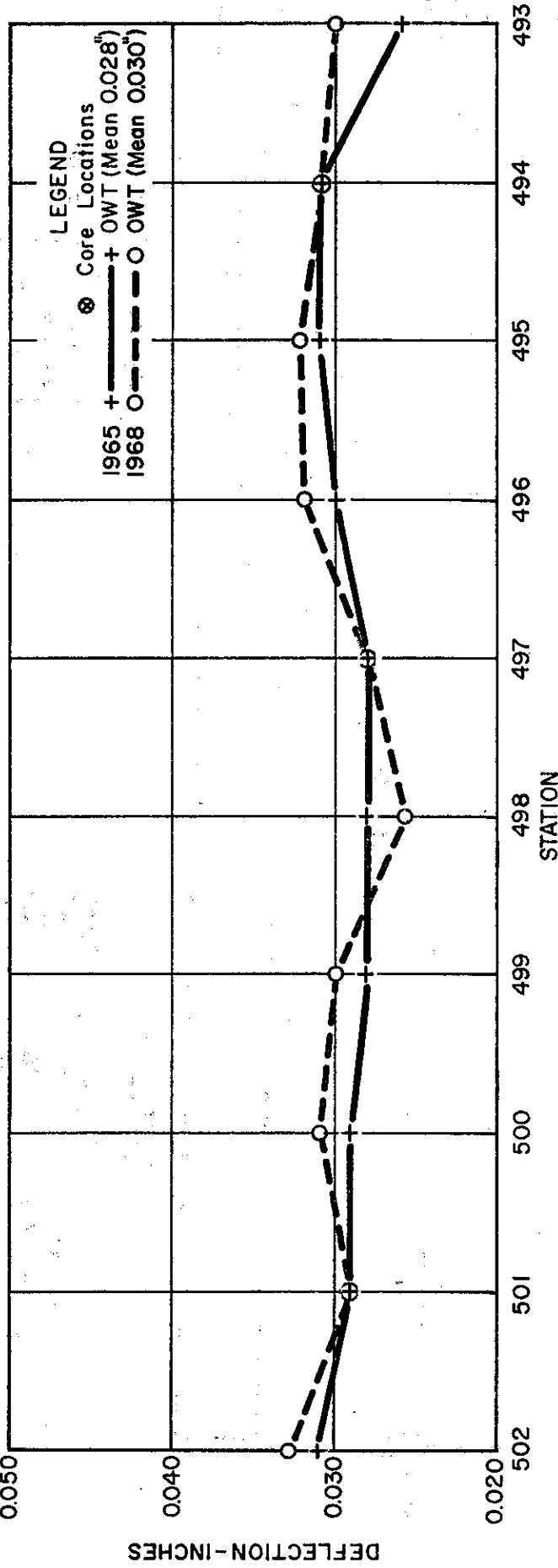
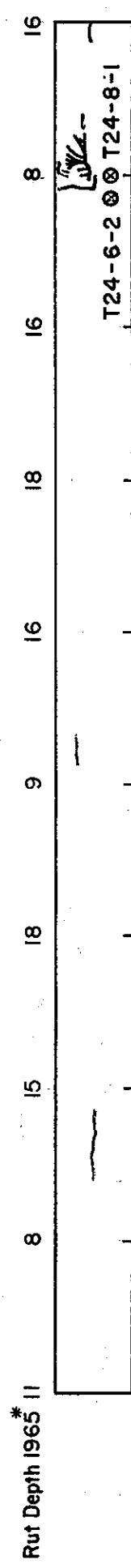


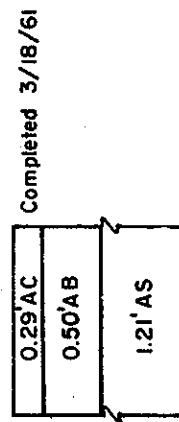
Figure 21



TEST DATA

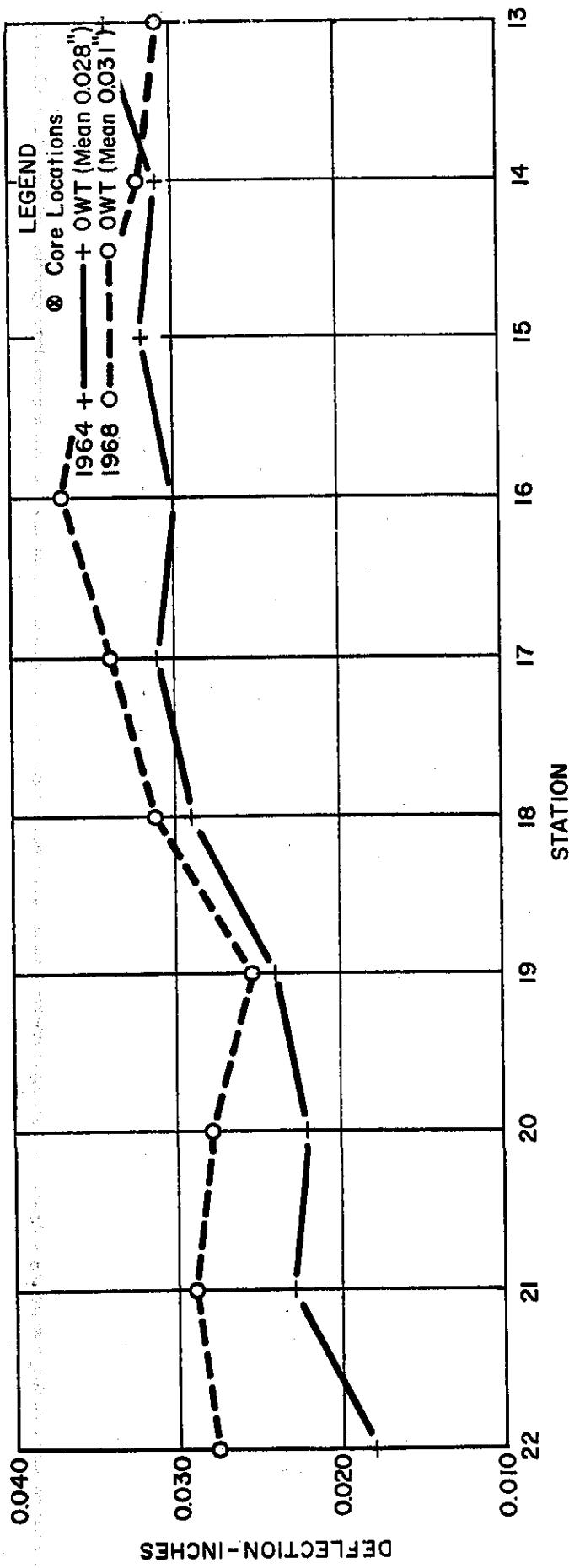
| | T24-6-2 | T24-8-1 |
|---------------------|---------|---------|
| % Asphalt | | 4.7 |
| Pen. at 77° F | 16 | 12 |
| S.P. (F°) | 155 | 160 |
| Duct. at 77° F (Cm) | 6 | 7 |

STRUCTURAL SECTION



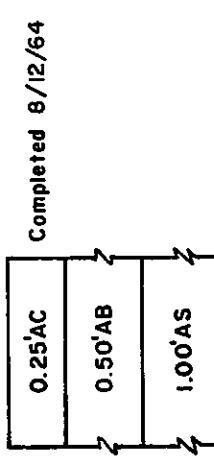
* Measured to nearest 0.001' in outer wheel track.

PROJECT. 20
10-Coi-49
CONT. 64-10T13C14
SOUTHBOUND LANE



T26-6-5 @ T26-8-6

STRUCTURAL SECTION



TEST DATA

| | T26-6-5 | T26-8-1 |
|--------------------|---------|---------|
| % Asphalt | 4.6 | |
| Pen. at 77° F | 30 | /23 |
| S.P. (F°) | 130 | 132 |
| Duct at 77° F (Cm) | 100+ | |

PROJECT 21

10 - Sol - 21

CONT. 60-10T C18-FI

WEST BOUND TRAVEL LANE

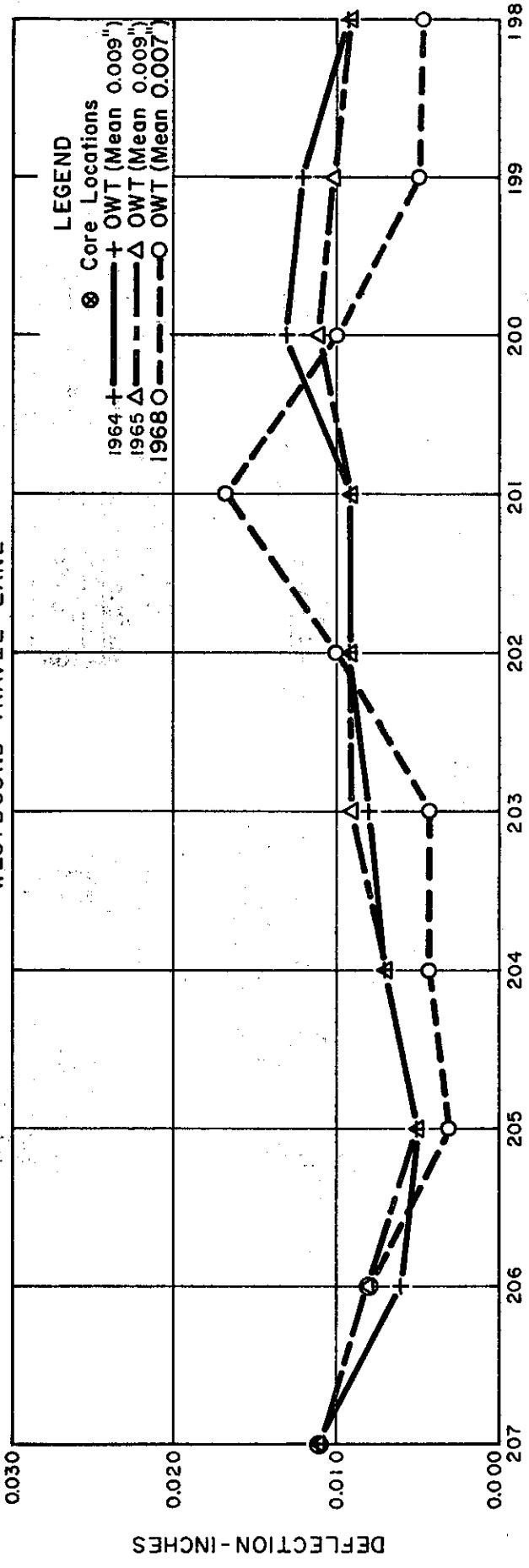
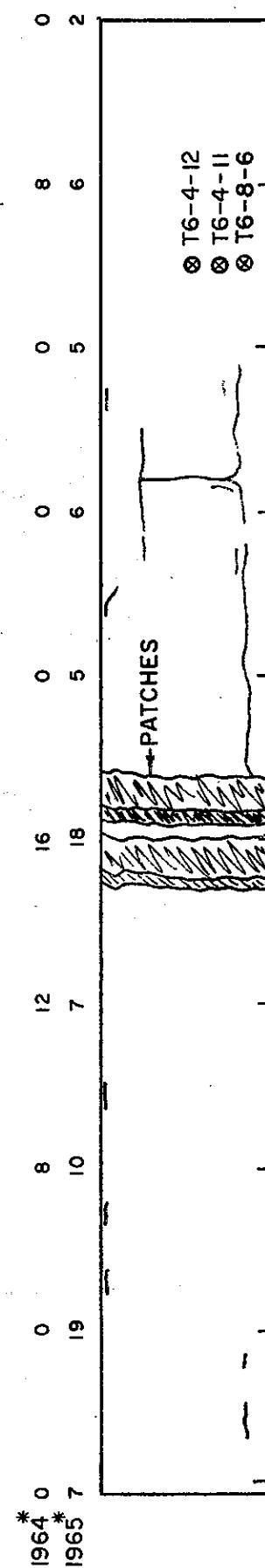


Figure 23

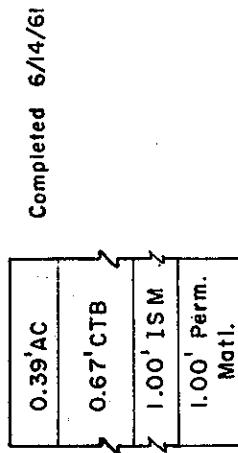
Rut Depth 1964 * 0
Rut Depth 1965 * 7



TEST DATA

| | T6-4-11 | T6-4-12 | T6-8-6 |
|--------------------|---------|---------|--------|
| % Asphalt | 5.5 | 5.3 | 4.7 |
| Pen. at 77°F | 20 | 30 | 14 |
| S.P. (F°) | 149 | 142 | 151 |
| Duct. at 77°F (Cm) | 35 | 100+ | 14 |

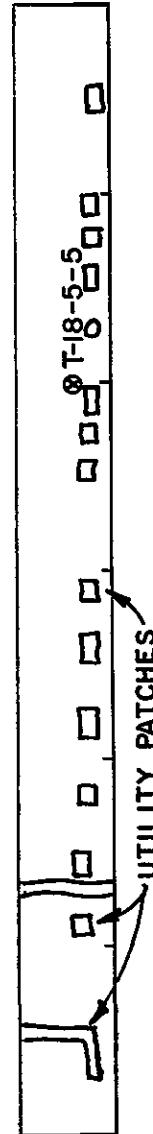
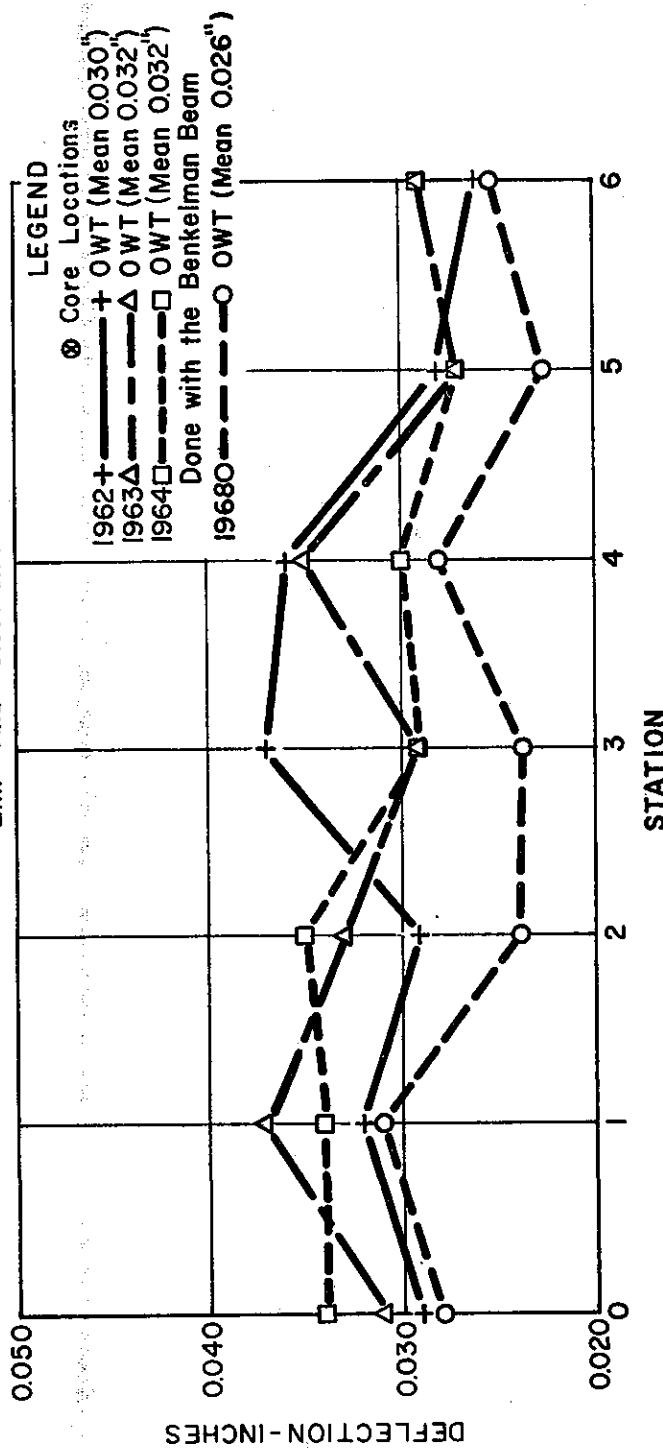
STRUCTURAL SECTION



* Measured to nearest 0.001' in outer wheel track.

PROJECT 22A & 22B
City of Woodland - (03)
Cross Street Between
Elm And Cleveland

Figure 24



| <u>TEST DATA</u> | |
|--------------------|----------|
| STRUCTURAL SECTION | |
| Sta. 0+00 to 3+50 | T-18-5-5 |
| 0.17' AC | 4.3 |
| 0.50' AB | |
| % Asphalt | |
| Pen. at 77°F | 27 |
| S.P. (F°) | 141 |
| Duct. at 77°F (Cm) | 100+ |

| | | |
|-----------------|-------------------|--------------------------|
| SECTION | Sta. 3+50 to 6+25 | Completed Summer of 1962 |
| Original Ground | 0.33' AC | |

